

APPENDIX A

DETERMINATION OF INFILTRATION AND RECHARGE RATES

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APPENDIX A

DETERMINATION OF INFILTRATION AND RECHARGE RATES

A.1 INFILTRATION AND RECHARGE RATES

EPACMTP requires the input of the rate of downward percolation of water and leachate through the unsaturated zone to the water table. The model distinguishes between two types of percolation as infiltration and recharge:

- **Infiltration** (WMU leakage rate) is defined as water percolating through the WMU – including a liner if present – to the underlying soil.
- **Recharge** is water percolating through the soil to the aquifer outside the WMU.

Infiltration is one of the key parameters affecting the leaching of waste constituents into the subsurface. For a given leachate concentration, the mass of constituents leached is directly proportional to the infiltration rate. In EPACMTP, using a different default liner scenario changes the modeled infiltration rate; more protective liner designs reduce leaching by decreasing the rate of infiltration.

In contrast, recharge introduces pristine water into the aquifer. Increasing recharge therefore tends to result in a greater degree of plume dilution and lower constituent concentrations. High recharge rates may also affect the extent of ground-water mounding and ground-water velocity. The recharge rate is independent of the type and design of the WMU; rather it is a function of the climatic and hydrogeological conditions at the WMU location, such as precipitation, evapotranspiration, surface run-off, and regional soil type.

In developing the EPACMTP model and the accompanying databases, the U.S. EPA used several methodologies to estimate infiltration and recharge. We used the HELP model (Schroeder et al, 1994) to compute recharge rates for all units, as well as infiltration rates for LAUs, and for LFs and WPs with no-liner and single-liner designs. For LFs and WPs, composite liner infiltration rates were compiled from leak-detection-system flow rates reported for actual composite-lined waste units (TetraTech, 2001).

For unlined and single-lined SIs, infiltration through the bottom of the impoundment is calculated internally by EPACMTP, as described in Section 4.3.4 of this document. For composite-lined SIs, we used the Bonaparte (1989) equation to calculate the infiltration rate assuming circular (pin-hole) leaks with a uniform leak size of 6 mm^2 , and using the distribution of leak densities (number of leaks per hectare) assembled from the survey of composite-lined units (TetraTech, 2001).

Tables A.1 through A.4 summarize the liner assumptions and infiltration rate calculations for LFs, WPs, SIs, and LAUs. The remainder of this appendix provides background on how we used the HELP model in conjunction with data from climate stations across the United States to develop nationwide recharge and infiltration rate

distributions and provides a detailed discussion of how we developed infiltration rates for different default liner designs for each type of WMU.

A.1.1 USING THE HELP MODEL TO DEVELOP RECHARGE AND INFILTRATION RATES

The HELP model is a quasi-two-dimensional hydrologic model for computing water balances of LFs, cover systems, and other solid waste management facilities. The primary purpose of the model is to assist in the comparison of design alternatives. The HELP model uses weather, soil and design data to compute a water balance for LF systems accounting for the effects of surface storage, snowmelt, runoff, infiltration, evapotranspiration, vegetative growth, soil moisture storage, lateral subsurface drainage, leachate recirculation, unsaturated vertical drainage, and leakage through soil, geomembrane or composite liners. The HELP model can simulate LF systems consisting of various combinations of vegetation, cover soils, waste cells, lateral drain layers, low permeability barrier soils, and synthetic geomembrane liners.

HELP Versions 3.03 and 3.07 (which include WMU- and liner-specific distributions of infiltration rates) were used to construct the EPACMTP site data files. We started with an existing database of no-liner infiltration rates for LFs, WPs and LAUs. Also existing were recharge rates for 97 climate stations in the lower 48 contiguous United States (ABB, 1995), that are representative of 25 specific climatic regions (developed with HELP version 3.03). We then added five climate stations (located in Alaska, Hawaii, and Puerto Rico) to ensure coverage throughout all of the United States. Figure A.1 shows the locations of the 102 climate stations.

The current version of HELP (version 3.07) was used for the modeling of the additional climate stations for the no-liner scenario. We compared the results of Version 3.07 against Version 3.03 and found that the differences in calculated infiltration rates were insignificant. We also used this comparison to verify a number of counter-intuitive infiltration rates that were generated with HELP Version 3.03. We had observed that for some climate stations located in areas of the country with low precipitation rates, the net infiltration for unlined LFs did not always correlate with the relative permeability of the LF cover. We found some cases in which a less permeable cover resulted in a higher modeled infiltration rate as compared to a more permeable cover. Examples can be seen in the detailed listing of infiltration data that are presented in Tables A.11 to A.14. For instance, Table A.11 shows that for a number of climate stations, including Albuquerque, Denver, and Las Vegas, the modeled infiltration rate for LFs with a silty clay loam (SCL) cover is higher than the values corresponding to silt loam (SLT) and sandy loam (SNL) soil covers. We determined that in all these cases, the HELP modeling results for unlined LFs were correct and could be explained in terms of other water balance components, including surface run-off and evapotranspiration.

Table A.1 Methodology Used to Compute Infiltration for LFs

	No Liner	Single Liner	Composite Liner
Method	HELP model simulations to compute an empirical distribution of infiltration rates for a 2 ft. thick cover of three native soil cover types using nationwide coverage of climate stations. Soil-type specific infiltration rates for a specific site are assigned by using the infiltration rates for respective soil types at the nearest climate station.	HELP model simulations to compute an empirical distribution of infiltration rates through a single clay liner using nationwide coverage of climate stations. Infiltration rates for a specific site were obtained by using the infiltration rate for the nearest climate station.	Compiled from literature sources (TetraTech, 2001) for composite liners
Final Cover	Monte Carlo selection from distribution of soil cover types. 2 ft thick native soil (1 of 3 soil types: silty clay loam, silt loam, and sandy loam) with a range of mean hydraulic conductivities (4.2×10^{-5} cm/s to 7.2×10^{-4} cm/s).	3 ft thick clay cover with a hydraulic conductivity of 1×10^{-7} cm/sec and a 10 ft thick waste layer. On top of the cover, a 1 ft layer of loam to support vegetation and drainage and a 1 ft percolation layer.	No cover modeled; the composite liner is the limiting factor in determining infiltration
Liner Design	No liner	3 ft thick clay liner with a hydraulic conductivity of 1×10^{-7} cm/sec. No leachate collection system. Assumes constant infiltration rate (assumes no increase in hydraulic conductivity of liner) over modeling period.	60 mil HDPE layer with either an underlying geosynthetic clay liner with maximum hydraulic conductivity of 5×10^{-9} cm/sec, or a 3-foot compacted clay liner with maximum hydraulic conductivity of 1×10^{-7} cm/sec. Assumes same infiltration rate (i.e., no increase in hydraulic conductivity of liner) over modeling period.
EPACMTP Infiltration Rate	Monte Carlo selection from HELP generated location-specific values.	Monte Carlo selection from HELP generated location-specific values.	Monte Carlo selection from distribution of leak detection system flow rates.

Table A.2 Methodology Used to Compute Infiltration for SIs

	No Liner	Single Liner	Composite Liner
Method	EPACMTP SI module for infiltration through consolidated sludge and native soil layers with a unit-specific ponding depth from EPA's SI Study (EPA, 2001).	EPACMTP module for infiltration through a layer of consolidated sludge and a single clay liner with unit-specific ponding depth from EPA's SI study.	Bonaparte equation (1989) for pin-hole leaks using distribution of leak densities for units installed with formal CQA programs
Ponding Depth	Unit-specific based on EPA's SI study.	Unit-specific based on EPA's SI study.	Unit-specific based on EPA's SI study.
Liner Design	None. However, barrier to infiltration is provided by layer of consolidated sludge at the bottom of the impoundment, and a layer of clogged native soil below the consolidated sludge. The sludge thickness is assumed to be constant over the modeling period. The hydraulic conductivity of the consolidated sludge is between 1.3×10^{-7} and 1.8×10^{-7} cm/sec. The hydraulic conductivity of the clogged native material is assumed to be 0.1 of the unaffected native material in the vadose zone.	3 ft thick clay liner with a hydraulic conductivity of 1×10^{-7} cm/sec. No leachate collection system. Assumes no increase in hydraulic conductivity of liner over modeling period. Additional barrier is provided by a layer of consolidated sludge at the bottom of the impoundment, see no-liner column.	60 mil HDPE layer with either an underlying geosynthetic clay liner with maximum hydraulic conductivity of 5×10^{-9} cm/sec, or a 3-foot compacted clay liner with maximum hydraulic conductivity of 1×10^{-7} cm/sec. Assumptions: 1) constant infiltration rate (i.e., no increase in hydraulic conductivity of liner) over modeling period; 2) geomembrane liner is limiting factor that determines infiltration rate.
EPACMTP Infiltration Rate	Calculated by EPACMTP based on Monte Carlo selection of unit-specific ponding depth.	Calculated based on Monte Carlo selection of unit-specific ponding depth	Calculated based on Monte Carlo selection of unit-specific ponding depth and distribution of leak densities

Table A.3 Methodology Used to Compute Infiltration for WPs

	No Liner	Single Liner	Composite Liner
Method	HELP model simulations to compute distribution of infiltration rates for a 10 ft. thick layer of waste, using three waste permeabilities (copper slag, coal bottom ash, coal fly ash) and nationwide coverage of climate stations. Waste-type-specific infiltration rates for a specific site are obtained by using the infiltration rates for respective waste types at the nearest climate station.	HELP model simulations to compute distribution of infiltration rates through 10 ft. waste layer using three waste permeabilities and nationwide coverage of climate stations. Infiltration rates for a specific site were obtained by using the infiltration rate for the nearest climate station.	Compiled from literature sources (TetraTech, 2001) for composite liners
Cover	None	None	None
Liner Design	No liner.	3 ft thick clay liner with a hydraulic conductivity of 1×10^{-7} cm/sec, no leachate collection system, and a 10 ft thick waste layer. Assumes no increase in hydraulic conductivity of liner over unit's operational life.	60 mil HDPE layer with either an underlying geosynthetic clay liner with maximum hydraulic conductivity of 5×10^{-9} cm/sec, or a 3-foot compacted clay liner with maximum hydraulic conductivity of 1×10^{-7} cm/sec. 1) same infiltration rate (i.e., no increase in hydraulic conductivity of liner) over unit's operational life; 2) geomembrane is limiting factor in determining infiltration rate.
EPACMTP Infiltration Rate	Monte Carlo selection from HELP generated location-specific values.	Monte Carlo selection from HELP generated location-specific values.	Monte Carlo selection from distribution of leak detection system flow rates

Table A.4 Methodology Used to Compute Infiltration for LAUs

	No Liner	Single Liner	Composite Liner
Method	HELP model simulations to compute an empirical distribution of infiltration rates for a 0.5 ft thick sludge layer, underlain by a 3 ft layer of three types of native soil using nationwide coverage of climate stations. Soil-type specific infiltration rates for a specific site are assigned by using the infiltration rates for respective soil types at the nearest climate station.	N/A	N/A
Liner Design	No liner	N/A	N/A
EPACMTP Infiltration Rate	Monte Carlo selection from HELP generated location specific values.	N/A	N/A

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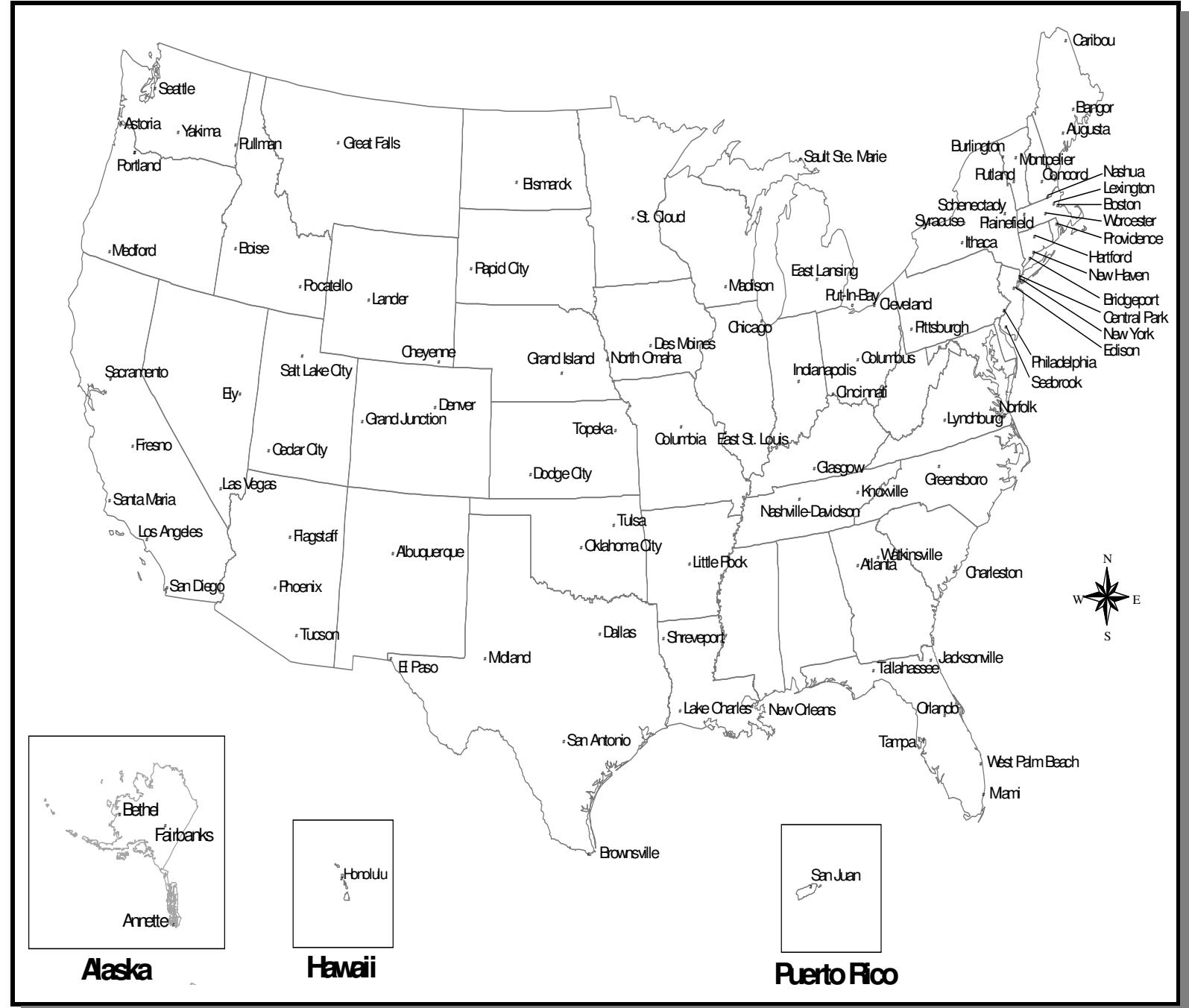


Figure A.1 Locations of HELP Climate Stations

The first 97 climate stations were grouped into 25 climate regions based on ranges of average annual precipitation and pan evaporation, as shown in Table A.5. For each modeled climate station, HELP provides a database of five years of climatic data. We used this climatic data, along with data on the regional soil type and WMU design characteristics, to calculate a water balance for each applicable default liner design as a function of the amount of precipitation that reaches the top surface of the unit, minus the amount of runoff and evapotranspiration. The HELP model then computed the net amount of water that infiltrates through the surface, waste, and liner layers, based on the initial moisture content and the hydraulic conductivity of each layer.

In addition to climate factors and liner designs, the infiltration rates calculated by HELP are affected by LF cover design, permeability of the waste material in WP, and LAU soil type. For every climate station and WMU type (LF, WP and LAU), we calculated three HELP infiltration rates. For a selected WMU type and liner design, the regional site-based modeling process selects randomly from among the HELP-derived infiltration and recharge data, to capture both the nationwide variation in climate conditions, as well as variations in LF soil cover type, WP waste permeability, and LAU soil type.

The factors related to soil type that affect the HELP-generated infiltration and recharge rates are the permeability of the soil used in the LF cover, and – in the case of recharge or for LAUs – the permeability of the soil type in the vicinity of the WMU. We used the same set of soil types (sandy loam, silty loam, and silty clay loam) and soil properties in the infiltration and recharge rate calculations as we did in the unsaturated zone fate and transport simulations (see Table 5.4 in Section 5.2.4).

In the case of uncovered WPs we found that the infiltration rates predicted by the HELP model are sensitive to the permeability of the waste material itself. Based on these results, we simulated WP infiltration rates for three different WP materials: relatively high permeability, moderate permeability, and relatively low permeability. When these rates are used in the EPACMTP modeling, each waste type has an equal likelihood of occurrence.

Table A.5 Grouping of Climate Stations by Average Annual Precipitation and Pan Evaporation (ABB, 1995)

City	State	Climate Region		City	State	Climate Region	
		Precipitation (in/yr)	Evaporation (in/yr)			Precipitation (in/yr)	Evaporation (in/yr)
Boise	ID	< 16	< 30	Columbia	MO	32 - 40	30 - 40
Fresno	CA			Put-in-Bay	OH		
				Madison	WI		
Bismarck	ND	< 16	30 - 40	Columbus	OH		
Denver	CO			Cleveland	OH		
Grand Junction	CO			Des Moines	IA		
Pocatello	ID			E. St. Louis	IL		
Glasgow	MT						
Pullman	WA			Topeka	KS	32 - 40	40 - 50
Yakima	WA						
Cheyenne	WY			Tampa	FL	32 - 40	50 - 60
Lander	WY			San Antonio	TX		
Rapid City	SD	< 16	40 - 50	Portland	ME	40 - 48	< 30
Los Angeles	CA			Hartford	CT		
Sacramento	CA			Syracuse	NY		
San Diego	CA			Worchester	MA		
Santa Maria	CA			Augusta	ME		
Ely	NV			Providence	RI		
Cedar City	UT			Nashua	NH		
				Ithaca	NY		
Albuquerque	NM	< 16	50 - 60	Boston	MA		
				Schenectady	NY		
Las Vegas	NV	< 16	> 60				
Phoenix	AZ			NY City	NY	40 - 48	30 - 40
Tucson	AZ			Lynchburg	VA		
El Paso	TX			Philadelphia	PA		
				Seabrook	NJ		
Medford	OR	16 - 24	30 - 40	Indianapolis	IN		
Great Falls	MT			Cincinnati	OH		
Salt Lake City	UT			Bridgeport	CT		
Grand Island	NE	16 - 24	40 - 50	Jacksonville	FL	40 - 48	40 - 50
				Orlando	FL		

Table A.5 Grouping of Climate Stations by Average Annual Precipitation and Pan Evaporation (ABB, 1995) (continued)

City	State	Climate Region		City	State	Climate Region	
		Precipitation (in/yr)	Evaporation (in/yr)			Precipitation (in/yr)	Evaporation (in/yr)
Flagstaff	AZ	16 - 24	50 - 60	Greensboro	NC		
				Watkinsville	GA		
Dodge City	KS	16 - 24	> 60	Norfolk	VA		
Midland	TX			Shreveport	LA		
St. Cloud	MN	24 - 32	< 30	Astoria	OR	> 48	< 30
				New Haven	CT		
E. Lansing	MI	24 - 32	30 - 40	Plainfield	MA		
North Omaha	NE	24 - 32	40 - 50	Nashville	TN	> 48	30 - 40
				Knoxville	TN		
Dallas	TX	24 - 32	50 - 60	Central Park	NY		
Tulsa	OK			Lexington	KY		
Brownsville	TX			Edison	NJ		
Oklahoma City	OK	24 - 32	>60	Atlanta	GA	> 48	40 - 50
				Little Rock	AK		
Bangor	ME	32 - 40	< 30	Tallahassee	FL		
Concord	NH			New Orleans	LA		
Pittsburgh	PA			Charleston	SC		
Portland	OR			W. Palm Beach	FL		
Caribou	ME						
Chicago	IL			Lake Charles	LA	> 48	50 - 60
Burlington	VT			Miami	FL		
Rutland	VT						
Seattle	WA						
Montpelier	VT						
Sault St. Marie	MI						

A.1.2 INFILTRATION RATES FOR UNLINED UNITS

Landfill

We used the HELP model to simulate infiltration through closed LFs for each of the 102 climate station locations shown in Figure A.1. A 2-foot cover was included as the minimum Subtitle D requirement. Three different soil cover types were modeled: sandy loam, silty loam, and silty clay loam soils. Table A.6 presents the hydraulic parameters for these three soil types.

Table A.6 Hydraulic Parameters for the Modeled Soils

Soil Type	HELP Soil Number	Total Porosity (vol/vol)	Field Capacity (vol/vol)	Wilting Point (vol/vol)	Saturated Hydraulic Conductivity (cm/sec)
Sandy Loam	6	0.453	0.190	0.085	0.000720
Silt Loam	9	0.501	0.284	0.135	0.000190
Silty Clay Loam	12	0.471	0.342	0.210	0.000042

Other LF design criteria included:

- A cover crop of “fair” grass — this is the quality of grass cover suggested by the HELP model for LFs where limitations to root zone penetration and poor irrigation techniques may limit grass quality.
- The evaporation zone thickness selected for each location was generally the depth suggested by the model for that location for a fair grass crop; however, the evaporation zone thickness was not allowed to exceed the soil thickness (24 inches).
- The leaf area index (LAI) selected for each location was that of fair grass (2.0) unless the model indicated a lower maximum for that location.
- The LF configuration was based on a one-acre facility with a 2% top slope and a drainage length of 200 feet (one side of a square acre). Runoff was assumed to be possible from 100% of the cover.

Table A.11 presents the LF infiltration rate data for the 102 climate stations. For all four WMU types, the unlined LF infiltration rate for each soil type at each of the 102 climate centers was used as the ambient regional recharge rate for that climatic center and soil type.

Surface Impoundment

We calculated SI infiltration rates using the built-in SI module in EPACMTP (see Section 4.3.4 of this document and Section 2.2.2.3 of the *EPACMTP Technical Background Document* (U.S. EPA, 2003a)). This means that for EPACMTP, the SI infiltration rate is not really an input parameter, rather the model calculates infiltration rates “on the fly” during the simulation, as a function of impoundment ponding depth and other SI characteristics. For unlined SIs, the primary parameters that control the infiltration rate are the ponding depth in the impoundment, the thickness and permeability of any accumulated sediment layer at the base of the impoundment, and the presence of a ‘clogged’ (i.e., reduced permeability) layer of native soil underneath the impoundment caused by the migration of solids from the impoundment. In addition, EPACMTP checks that the calculated infiltration rate does not result in an unrealistic degree of ground-water mounding (see Section 2.2.5 of the *EPACMTP Technical Background Document* (U.S. EPA, 2003a)).

To create the SI site data file for use with EPACMTP, we used unit-specific data on SI ponding depths from EPA’s *Surface Impoundment Study* (U.S. EPA, 2001). We assumed a fixed sediment layer thickness of 20 cm at the base of the impoundment. The resulting sediment layer permeability has a relatively narrow range of variation between 1.26×10^{-7} and 1.77×10^{-7} cm/s. We assumed that the depth of clogging underneath the impoundment was 0.5 m in all cases, and that saturated hydraulic conductivity of the clogged layer is 10% of that of the native soil underlying the impoundment.

In the event that the SI is reported to have its base below the water table, we calculated the infiltration using Darcy’s law based on the hydraulic gradient across the bottom of the impoundment unit, and the hydraulic conductivity of the consolidated sediment at the bottom of the impoundment unit.

Waste Pile

For the purpose of estimating leaching rates, we considered WPs to be similar to non-covered LFs with a total waste thickness of 10 feet. The infiltration rates for unlined WPs were, therefore, generated with the HELP model using the same general procedures as for LFs, but with the following modifications:

- *No cover*
We modeled the leachate flux through active, uncovered piles. We modeled the WP surface as having no vegetation. The evaporative zone depth was taken as the suggested HELP model value for the “bare” condition at each climate center. The Leaf Area Index (LAI) was set to zero to eliminate transpiration.
- *Variable waste permeability*
For uncovered WPs, we found that the infiltration rates predicted by HELP model are sensitive to the permeability of the waste material itself. Based on these results, we simulated WP infiltration rates for

three different WP materials: relatively high permeability, moderate permeability, and relatively low permeability (rather than three different soil types as was done for the LF scenario). The HELP model input parameters for the three waste types are presented in Table A.7.

Table A.7 Moisture Retention Parameters for the Modeled WP Materials

Waste Type	HELP Soil Number	Total Porosity (vol/vol)	Field Capacity (vol/vol)	Wilting Point (vol/vol)	Saturated Hydraulic Conductivity (cm/sec)
Low Permeability	30	0.541	0.187	0.047	0.00005
Moderate Permeability	31	0.578	0.076	0.025	0.00410
High Permeability	33	0.375	0.055	0.020	0.04100

We calculated WP infiltration rates for the 102 climate stations shown in Figure A.1 and the three waste material permeabilities shown in Table A.7. Table A.12 presents the resulting WP infiltration rate values for all climate stations and waste types.

Land Application Unit

LAUs were modeled with HELP using two soil layers. The top layer was taken as six inches in thickness and represented the layer into which the waste was applied. The bottom layer was of the same material type as the top layer and was set at a thickness of 36 inches. Both of these layers were modeled as vertical percolation layers. The same three soil types for LFs were also used for LAUs (see Table A.6).

We assumed the waste applied to the LAU to be a sludge-type material with a high water content. We also assumed a waste application rate of 7.25 inches per year (in/yr) with the waste having a solids content of 20% and a unit weight of 75 lb/ft³. Assuming that 100% of the water in the waste was available as free water, an excess water amount of 5.8 in/yr, in addition to precipitation, would be available for percolation. HELP model analyses showed that the additional water available for percolation generally would have little effect on the simulated water balance and net infiltration, except for sites located in arid regions of the United States with very little natural precipitation. For more representative waste application rates, the effect disappeared because introducing additional moisture in the simulated water balance results in a commensurate increase in runoff and removal by evapotranspiration. For this reason, the LAU infiltration rate for a given soil type is assumed to be the same as the corresponding LF infiltration rate.

We calculated LAU infiltration rates for the 102 climate stations shown in Figure A.1 and the three soil types shown in Table A.6. Table A.13 presents the resulting LAU infiltration rate values for all climate stations and soil types.

A.1.3 **SINGLE-LINED WASTE UNITS**

EPACMTP includes infiltration rates for single clay-lined LFs, WPs, and SIs. In the case of LAUs, only unlined units are considered.

Landfill

We calculated infiltration rates for single-lined LFs using version 3.07 of the HELP model. We modeled the LF as a four-layer system, consisting, from top to bottom of:

- 1-foot percolation cover layer;
- 3-foot compacted clay cover with hydraulic conductivity of 1×10^{-7} cm/s ;
- 10-foot thick waste layer; and
- 3-foot thick compacted clay liner with a hydraulic conductivity of 1×10^{-7} cm/sec.

We simulated the cover layer as a loam drainage layer supporting a “fair” cover crop with an evaporative zone depth equal to that associated with a fair cover crop at the climate center. The remaining conditions were identical to those described in Section A.1.2 for unlined LFs. Note that three different soil types were not modeled, since the clay liner is the limiting factor affecting the infiltration rate, not soil type. To avoid changing the standard format of the infiltration rates in the site data file, the clay-lined LF infiltration rates are repeated in each of the three columns that correspond to soil type in the case of unlined LFs. So in the course of a Monte Carlo analysis using the regional site-based modeling methodology for a single-clay lined LF, the soil type is correlated only to recharge rate.

In developing this default distribution of infiltration rates, we used the grouping of climate stations into 25 regions of similar climatic conditions depicted in Table A.5 in order to reduce the number of required HELP simulations. Rather than calculating infiltration rates for each of the 102 individual climate stations, we calculated infiltration rates for the 25 climate regions, and then assigned the same value to each climate station in one group. To ensure a protective result, we chose the climate center with the highest average precipitation in each climate region as representative of that region. We calculated individual infiltration rates for each of the five climate centers in Alaska, Hawaii, and Puerto Rico that were not assigned to a climate region.

During the process of assembling the HELP infiltration values for the EPACMTP model, we realized that the grouping of climate centers into regions for clay-lined units resulted in a number of apparent anomalies in which the suggested infiltration rate for a lined unit would be higher than the unlined infiltration rate at the same climate station. This resulted from the fact that we used the infiltration rate for

the climate center with the highest annual precipitation in each region for clay-lined units, but then compared it with a location-specific infiltration value for unlined units. The occurrence of these anomalies was restricted to climate stations in arid parts of the United States, and was noticeable only when the absolute magnitude of infiltration was low. In order to remove these counter-intuitive results, we re-calculated location-specific HELP infiltration rates for clay-lined units at 17 climate stations (Glasgow, MT; Yakima, WA; Lander, WY; Cheyenne, WY; Pullman, WA; Pocatello, ID; Grand Junction, CO; Denver, CO; Great Falls, MT; Salt Lake City, UT; Cedar City, UT; El Paso, TX; Ely, NV; Las Vegas, NV; Rapid City, SD; Phoenix, AZ; and Tucson, AZ). We then incorporated the location-specific infiltration rates for these 17 climate stations into the database of infiltration rates in the site data file, to replace the original regional values. The result is that some of the infiltration rates for the single-clay lined LF scenario are regional values and some are location-specific values. Table A.11 shows the infiltration rate values for clay-lined LFs.

Waste Pile

We calculated infiltration rates for single-lined WPs using the HELP model. We modeled the WP as a two-layer system, consisting, from top to bottom, of:

- 10-foot thick, uncovered, waste layer; and
- 3-foot thick compacted clay liner with a hydraulic conductivity of 1×10^{-7} cm/sec.

Other parameters were set to the same values as in the unlined WP case, including the three default waste material types (see Section A.1.2). We also modeled a bare surface for the evaporative zone depth.

In developing the single-clay lined-WP infiltration rates, we used the same grouping of climate stations in 25 climate regions as previously discussed for LFs. We calculated individual infiltration rates for each of the five climate centers in Alaska, Hawaii, and Puerto Rico that were not assigned to a climate region.

Analogous to the situation encountered for LFs, we found a number of apparent anomalies between WP infiltration rates for unlined as compared to clay-lined WPs, resulting from the use of regional infiltration values for clay-lined units. The occurrence of these anomalies for WPs was also restricted to climate centers in arid parts of the United States, for which the absolute magnitude of infiltration was low. In order to remove these counter-intuitive results, we re-calculated location-specific HELP infiltration rates for clay-lined WP units at 17 climate stations (Glasgow, MT; Yakima, WA; Lander, WY; Cheyenne, WY; Pullman, WA; Pocatello, ID; Grand Junction, CO; Denver, CO; Great Falls, MT; Salt Lake City, UT; Cedar City, UT; El Paso, TX; Ely, NV; Las Vegas, NV; Rapid City, SD; Phoenix, AZ; and Tucson, AZ). We then incorporated the location-specific infiltration rates for these 17 climate stations into the database of infiltration rates in the site data file, to replace the original regional values, and made them part of a distribution package for EPACMTP version 2. The result is that some of the infiltration rates for the

single-clay lined WP scenario are regional values and some are location-specific values.

During the process of verifying the HELP-generated infiltration rates for clay-lined units, we also replaced incorrect values for clay-lined WPs assigned to the Lake Charles, LA and Miami, FL climate stations. These two climate stations have high precipitation (Table A.5), but were assigned low infiltration rates. So for these two climate stations, we re-ran the HELP model for the clay-lined WP scenario for each of the three waste permeability values.

Table A.12 shows these finalized infiltration rate values for clay-lined WPs.

Surface Impoundment

For single-lined SIs, infiltration rates were calculated inside of EPACMTP in the same manner as described in the Section A.1.2 for unlined units, with the exception that we added a 3-foot compacted clay liner with a hydraulic conductivity of 1×10^{-7} cm/s at the bottom of the WMU, and we did not include the effect of clogged native material due to the filtering effects of the liner.

A.1.4 INFILTRATION RATES FOR COMPOSITE-LINED UNITS

We conducted an information collection effort that involved searching the available literature for data that quantify liner integrity and leachate infiltration through composite liners (TetraTech, 2001). We then assembled these data and applied them to develop the following methodologies for modeling infiltration from composite-lined units:

Landfill and Waste Pile

We treated composite-lined LFs and WPs as being the same for the purpose of determining infiltration rates. For these WMU's, we developed an infiltration rate distribution from actual leak detection system (LDS) flow rates reported for clay composite-lined LF cells, and incorporated them into an EPACMTP input file.

We based the distribution of composite-lined LF and WP infiltration rates on available monthly average LDS flow rates from 27 LF cells reported by TetraTech (2001). The data and additional detail for the 27 LF cells are provided in Appendix D, Table D.5 of the *IWEM Technical Background Document* (U.S. EPA, 2003c). The data included monthly average LDS flow rates for 22 operating LF cells and 5 closed LF cells. The 27 LF cells are located in eastern United States: 23 in the northeastern region, 1 in the mid-Atlantic region, and 3 in the southeastern region. Each of the LF cells is underlain by a geomembrane/geosynthetic clay liner which consists of a geomembrane of thickness between 1 and 1.5 mm (with the majority, 22 of 27, being 1.5 mm thick), overlying a geosynthetic clay layer of reported thickness of 6 mm. The geomembrane is a flexible membrane layer made from HDPE. The geosynthetic clay liner is a composite barrier consisting of two

geotextile outer layers with a uniform core of bentonite clay to form a hydraulic barrier. The liner system is underlain by a LDS.

We decided in this case to use a subset of the reported flow rates compiled by TetraTech (2001) in developing the composite liner infiltration rates for EPACMTP. We did not include LDS flow rates for geomembrane/compacted clay composite-lined LF cells in our distribution. For compacted clay liners (including composite geomembrane/ compacted clay liners), there is the potential for water to be released during the consolidation of the clay liner and yield an unknown contribution of water to LDS flow, such that it is very difficult to determine how much of the LDS flow is due to liner leakage, versus how much is due to clay consolidation. We also decided in this case to not use LDS flow rates from three geomembrane/geosynthetic clay lined-cells. For one cell, flow rate data were available for the cell's operating period and the cell's post-closure period. The average flow rate for the cell was 26 liters/hectare/day when the cell was operating and 59 liters/hectare/day when the cell was closed. We believe these flow rates, which were among the highest reported, are difficult to interpret because the flow rate from the closed cell was over twice the flow rate from the open cell, a pattern inconsistent with the other open cell/closed cell data pairs we reviewed. For the two other cells, additional verification of the data may be needed in order to fully understand the reported flow rates.

The resulting cumulative probability distribution of infiltration rates for composite-lined LFs and WPs for use in this application is based on the 27 remaining data points is presented in Table A.8. Note that over 50% of the values are zero; that is, they have no measurable infiltration.

Table A.8 Cumulative Frequency Distribution of Infiltration Rate for Composite-Lined LFs and WPs

Percentile	0	10	25	50	75	90	100
Infiltration Rate (m/yr)	0.0	0.0	0.0	0.0	7.30×10^{-5}	1.78×10^{-4}	4.01×10^{-4}

Surface Impoundment

For the surface impoundment scenario, the EPACMTP model derives a value for leakage through circular defects (pin holes) in a composite liner using the following equation developed by Bonaparte et al. (1989):

$$Q = 0.21a^{0.1} h^{0.9} K_s^{0.74} \quad (A.1)$$

where:

- Q = steady-state rate of leakage through a single hole in the liner (m^3/s)
- a = area of hole in the geomembrane (m^2)
- h = head of liquid on top of geomembrane (m)

K_s = hydraulic conductivity of the low-permeability soil underlying the geomembrane (m/s)

This equation is applicable to cases where there is good contact between the geomembrane and the underlying compacted clay liner. In the course of a Monte Carlo analysis using the regional site-based modeling methodology, the EPACMTP model derives the infiltration rate for each SI unit in the nationwide database included in the site data file using the above equation. This methodology uses the unit-specific ponding depth data (corresponding to h in the above equation) from the recent *Surface Impoundment Study* (U.S. EPA, 2001) in combination with a distribution of leak densities (expressed as number of leaks per hectare) compiled from 26 leak density values reported in TetraTech (2001). The leak densities are based on liners installed with formal Construction Quality Assurance (CQA) programs.

The 26 sites with leak density data are mostly located outside the United States: 3 in Canada, 7 in France, 14 in United Kingdom, and 2 with unknown locations. The WMUs at these sites (8 LFs, 4 SIs, and 14 unknown) are underlain by a layer of geomembrane of thickness varying from 1.14 to 3 mm. The majority of the geomembranes are made from HDPE (23 of 26) with the remaining 3 made from prefabricated bituminous geomembrane or polypropylene. One of the sites has a layer of compacted clay liner beneath the geomembrane, however, for the majority of the sites (25 of 26) material types below the geomembrane layer are not reported. The leak density data above were used for SIs. The leak density distribution is shown in Table A.9. Table D.6, Appendix D of the *IWEM Technical Background Document* (U.S. EPA, 2003c) provides additional detail.

To use the Bonaparte equation, the EPACMTP model assumes a uniform leak size of 6 millimeters squared (mm^2). This leak size is the middle of a range of hole sizes reported by Rollin et al. (1999), who found that 25 percent of holes were less than 2 mm^2 , 50 percent of holes were 2 to 10 mm^2 , and 25 percent of holes were greater than 10 mm^2 . Additionally, the model assumes that the geomembrane is underlain by a compacted clay liner whose hydraulic conductivity is $1 \times 10^{-7} \text{ cm/s}$.

In order to ascertain the plausibility of the leak density data, we conducted an infiltration rate calculation to estimate the range of infiltration resulting from the leaks in geomembrane. Because of the absence of documented infiltration data for SIs, for comparison purposes we used the infiltration data for LFs, described previously under the LF and WP sections, as a surrogate infiltration data set. Because the comparison was made on the basis of LF data, we set the head of liquid above the geomembrane to 0.3 m (1 foot) which is a typical maximum design head for LFs. Calculation results are shown in Table D.6, Appendix D of the *IWEM Technical Background Document* (U.S. EPA, 2003c). These results indicate that the calculated leakage rates, based on the assumptions of above-geomembrane head, hole dimension, hydraulic conductivity of the barrier underneath the geomembrane, and good contact between the geomembrane and the barrier, agree favorably with the observed LF flow rates reported in Table D.5, Appendix D of the *IWEM Technical Background Document* (U.S. EPA, 2003c). This result provided

confidence that the leak density data could be used as a reasonable basis for calculating infiltration rates using actual SI ponding depths. The empirical distribution of composite-lined infiltration rates for SIs is part of the EPACMTP input file, if example input files for the composite-lined scenario are to be included in a distribution package.

In order to use these data in EPACMTP, the user is required to specify the unit's ponding depth. EPACMTP will then determine the unit's infiltration distribution using the Bonaparte equation and the leak density distribution in Table A.9. The resulting frequency distribution of calculated infiltration rates for composite-lined SIs that are generated using the standard regional site-based modeling methodology is presented in Table A.10.

Table A.9 Cumulative Frequency Distribution of Leak Density for Composite-Lined SIs

Percentile	0	10	20	30	40	50	60	70	80	90	100
Leak density (No. Leaks/ha)	0	0	0	0	0.7	0.915	1.36	2.65	4.02	4.77	12.5

Table A.10 Cumulative Frequency Distribution of Infiltration Rate for Composite-Lined SIs

Percentile	0	10	25	50	75	90	100
Infiltration Rate (m/yr)	0.0	0.0	0.0	1.34×10^{-5}	1.34×10^{-4}	3.08×10^{-4}	4.01×10^{-3}

Table A.11 HELP-Derived Landfill Infiltration Rates

Climate Center Index	Climate Center		No Liner Infiltration Rate (m/yr)			Single Clay Liner Infiltration Rate (m/yr)		
	City	State	Silt Loam	Sandy Loam	Silty Clay	Silt Loam	Sandy Loam	Silty Clay
1	Fresno	CA	0.0307	0.0368	0.0381	0.0046	0.0046	0.0046
2	Boise	ID	0.0008	0.0094	0.0038	0.0046	0.0046	0.0046
3	Denver	CO	0.0008	0.0008	0.0036	0.0000	0.0000	0.0000
4	Grand Junction	CO	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000
5	Pocatello	ID	0.0000	0.0000	0.0000	0.0006	0.0006	0.0006
6	Glasgow	MT	0.0099	0.0074	0.0099	0.0001	0.0001	0.0001
7	Bismarck	ND	0.0239	0.0300	0.0196	0.0188	0.0188	0.0188
8	Pullman	WA	0.0069	0.0132	0.0084	0.0002	0.0002	0.0002
9	Yakima	WA	0.0000	0.0023	0.0003	0.0001	0.0001	0.0001

Climate Center Index	Climate Center		No Liner Infiltration Rate (m/yr)			Single Clay Liner Infiltration Rate (m/yr)		
	City	State	Silt Loam	Sandy Loam	Silty Clay	Silt Loam	Sandy Loam	Silty Clay
10	Cheyenne	WY	0.0005	0.0013	0.0086	0.0000	0.0000	0.0000
11	Lander	WY	0.0033	0.0053	0.0094	0.0001	0.0001	0.0001
12	Los Angeles	CA	0.0787	0.0950	0.0699	0.0013	0.0013	0.0013
13	Sacramento	CA	0.1024	0.0876	0.0945	0.0013	0.0013	0.0013
14	San Diego	CA	0.0221	0.0340	0.0241	0.0013	0.0013	0.0013
15	Santa Maria	CA	0.0947	0.1151	0.0841	0.0013	0.0013	0.0013
16	Ely	NV	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000
17	Rapid City	SD	0.0005	0.0071	0.0033	0.0001	0.0001	0.0001
18	Cedar City	UT	0.0000	0.0008	0.0000	0.0001	0.0001	0.0001
19	Albuquerque	NM	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000
20	Las Vegas	NV	0.0000	0.0000	0.0018	0.0001	0.0001	0.0001
21	Phoenix	AZ	0.0000	0.0003	0.0003	0.0000	0.0000	0.0000
22	Tucson	AZ	0.0000	0.0003	0.0005	0.0000	0.0000	0.0000
23	El Paso	TX	0.0076	0.0130	0.0081	0.0001	0.0001	0.0001
24	Medford	OR	0.2073	0.2309	0.2096	0.0432	0.0432	0.0432
25	Great Falls	MT	0.0036	0.0069	0.0074	0.0001	0.0001	0.0001
26	Salt Lake City	UT	0.0130	0.0269	0.0185	0.0005	0.0005	0.0005
27	Grand Island	NE	0.0442	0.0627	0.0323	0.0196	0.0196	0.0196
28	Flagstaff	AZ	0.0239	0.0630	0.0226	0.0241	0.0241	0.0241
29	Dodge City	KS	0.0135	0.0345	0.0226	0.0094	0.0094	0.0094
30	Midland	TX	0.0180	0.0254	0.0135	0.0094	0.0094	0.0094
31	St. Cloud	MN	0.0602	0.0831	0.0554	0.0342	0.0342	0.0342
32	E. Lansing	MI	0.1090	0.1452	0.1102	0.0374	0.0374	0.0374
33	North Omaha	NE	0.0671	0.0795	0.0536	0.0291	0.0291	0.0291
34	Tulsa	OK	0.0686	0.1006	0.0465	0.0241	0.0241	0.0241
35	Brownsville	TX	0.0549	0.1049	0.0384	0.0241	0.0241	0.0241
36	Dallas	TX	0.0599	0.1067	0.0531	0.0241	0.0241	0.0241
37	Oklahoma City	OK	0.0612	0.0942	0.0389	0.0246	0.0246	0.0246
38	Concord	NH	0.1585	0.2057	0.1372	0.0432	0.0432	0.0432
39	Pittsburgh	PA	0.0894	0.1313	0.0792	0.0432	0.0432	0.0432
40	Portland	OR	0.4171	0.4387	0.3927	0.0432	0.0432	0.0432
41	Caribou	ME	0.1082	0.1491	0.0886	0.0432	0.0432	0.0432

Climate Center Index	Climate Center		No Liner Infiltration Rate (m/yr)			Single Clay Liner Infiltration Rate (m/yr)		
	City	State	Silt Loam	Sandy Loam	Silty Clay	Silt Loam	Sandy Loam	Silty Clay
42	Chicago	IL	0.0798	0.1138	0.0620	0.0432	0.0432	0.0432
43	Burlington	VT	0.1359	0.1781	0.1166	0.0432	0.0432	0.0432
44	Bangor	ME	0.1471	0.2045	0.1227	0.0432	0.0432	0.0432
45	Rutland	VT	0.1212	0.1598	0.1008	0.0432	0.0432	0.0432
46	Seattle	WA	0.4384	0.4582	0.4077	0.0432	0.0432	0.0432
47	Montpelier	VT	0.1062	0.1483	0.0879	0.0432	0.0432	0.0432
	Sault St. Marie							
48		MI	0.1651	0.2101	0.1435	0.0432	0.0432	0.0432
49	Put-in-Bay	OH	0.0508	0.1003	0.0495	0.0409	0.0409	0.0409
50	Madison	WI	0.0912	0.1400	0.0686	0.0409	0.0409	0.0409
51	Columbus	OH	0.0765	0.1158	0.0663	0.0409	0.0409	0.0409
52	Cleveland	OH	0.0780	0.1212	0.0823	0.0409	0.0409	0.0409
53	Des Moines	IA	0.1143	0.1641	0.1156	0.0409	0.0409	0.0409
54	E. St. Louis	IL	0.1435	0.1676	0.0704	0.0409	0.0409	0.0409
55	Columbia	MO	0.1529	0.1989	0.1224	0.0409	0.0409	0.0409
56	Topeka	KS	0.1049	0.1483	0.0762	0.0350	0.0350	0.0350
57	Tampa	FL	0.0658	0.1031	0.0475	0.0253	0.0253	0.0253
	San Antonio							
58		TX	0.1095	0.1646	0.0820	0.0253	0.0253	0.0253
59	Hartford	CT	0.1709	0.2228	0.1405	0.0445	0.0445	0.0445
60	Syracuse	NY	0.2545	0.3251	0.2118	0.0445	0.0445	0.0445
61	Worchester	MA	0.2022	0.2591	0.1697	0.0445	0.0445	0.0445
62	Augusta	ME	0.2116	0.2700	0.1674	0.0445	0.0445	0.0445
63	Providence	RI	0.2131	0.2863	0.1753	0.0445	0.0445	0.0445
64	Portland	ME	0.2294	0.2840	0.1872	0.0445	0.0445	0.0445
65	Nashua	NH	0.2268	0.2812	0.1943	0.0445	0.0445	0.0445
66	Ithaca	NY	0.1684	0.2136	0.1392	0.0445	0.0445	0.0445
67	Boston	MA	0.2332	0.2383	0.1542	0.0445	0.0445	0.0445
68	Schenectady	NY	0.1473	0.1928	0.1224	0.0445	0.0445	0.0445
69	Lynchburg	VA	0.3081	0.3612	0.2570	0.0444	0.0444	0.0444
	New York City							
70		NY	0.2436	0.2944	0.1969	0.0444	0.0444	0.0444
71	Philadelphia	PA	0.2007	0.2609	0.1641	0.0444	0.0444	0.0444
72	Seabrook	NJ	0.1814	0.2428	0.1427	0.0444	0.0444	0.0444
73	Indianapolis	IN	0.1300	0.1862	0.1064	0.0444	0.0444	0.0444

Climate Center Index	Climate Center		No Liner Infiltration Rate (m/yr)			Single Clay Liner Infiltration Rate (m/yr)		
	City	State	Silt Loam	Sandy Loam	Silty Clay	Silt Loam	Sandy Loam	Silty Clay
74	Cincinnati	OH	0.1554	0.2210	0.1539	0.0444	0.0444	0.0444
75	Bridgeport	CT	0.1953	0.2464	0.1615	0.0444	0.0444	0.0444
76	Orlando	FL	0.1016	0.1697	0.0805	0.0362	0.0362	0.0362
77	Greensboro	NC	0.3256	0.3896	0.2705	0.0362	0.0362	0.0362
78	Jacksonville	FL	0.1511	0.2106	0.1102	0.0362	0.0362	0.0362
79	Watkinsville	GA	0.2891	0.3556	0.2332	0.0362	0.0362	0.0362
80	Norfolk	VA	0.2643	0.3857	0.1798	0.0362	0.0362	0.0362
81	Shreveport	LA	0.2296	0.2939	0.1842	0.0362	0.0362	0.0362
82	Astoria	OR	1.0762	1.1494	0.9647	0.0526	0.0526	0.0526
83	New Haven	CT	0.3520	0.4628	0.2855	0.0526	0.0526	0.0526
84	Plainfield	MA	0.1900	0.2540	0.1521	0.0526	0.0526	0.0526
85	Knoxville	TN	0.4107	0.4460	0.3543	0.0486	0.0486	0.0486
86	Central Park	NY	0.3363	0.4171	0.2738	0.0486	0.0486	0.0486
87	Lexington	KY	0.3294	0.3970	0.2700	0.0486	0.0486	0.0486
88	Edison	NJ	0.3122	0.3914	0.2492	0.0486	0.0486	0.0486
89	Nashville	TN	0.4674	0.5395	0.3769	0.0486	0.0486	0.0486
90	Little Rock	AK	0.3531	0.4336	0.2824	0.0477	0.0477	0.0477
91	Tallahassee	FL	0.5913	0.7308	0.4564	0.0477	0.0477	0.0477
92	New Orleans	LA	0.5893	0.7445	0.4503	0.0477	0.0477	0.0477
93	Charleston	SC	0.2609	0.3287	0.2123	0.0477	0.0477	0.0477
94	W. Palm Beach	FL	0.2611	0.3490	0.1783	0.0477	0.0477	0.0477
95	Atlanta	GA	0.3416	0.3993	0.2822	0.0477	0.0477	0.0477
96	Lake Charles	LA	0.3647	0.4641	0.2817	0.0492	0.0492	0.0492
97	Miami	FL	0.1450	0.2201	0.1019	0.0492	0.0492	0.0492
98	Annette	AK	1.6833	1.8354	1.4610	0.0338	0.0338	0.0338
99	Bethel	AK	0.0564	0.0721	0.0554	0.0295	0.0295	0.0295
100	Fairbanks	AK	0.0104	0.0234	0.0117	0.0094	0.0094	0.0094
101	Honolulu	HI	0.0523	0.0945	0.0366	0.0048	0.0048	0.0048
102	San Juan	PR	0.1267	0.1923	0.0945	0.0193	0.0193	0.0193

Table A.12 HELP-derived Waste Pile Infiltration Rates

Climate Center Index	Climate Center		No Liner Infiltration Rate (m/yr)			Single Clay Liner Infiltration Rate (m/yr)		
	City	State	Low	Med	High	Low	Med	High
			Silt Loam	Sandy Loam	Silty Clay	Silt Loam	Sandy Loam	Silty Clay Loam
1	Fresno	CA	0.0206	0.0422	0.0963	0.0136	0.0434	0.0606
2	Boise	ID	0.0053	0.0003	0.0318	0.0136	0.0434	0.0606
3	Denver	CO	0.0130	0.0366	0.0958	0.0020	0.0013	0.0037
4	Grand Junction	CO	0.0053	0.0003	0.0178	0.0046	0.0017	0.0020
5	Pocatello	ID	0.0069	0.0020	0.0579	0.0059	0.0015	0.0319
6	Glasgow	MT	0.0056	0.0043	0.0554	0.0005	0.0002	0.0234
7	Bismarck	ND	0.0056	0.0003	0.0356	0.0124	0.0689	0.0950
8	Pullman	WA	0.0112	0.0259	0.1001	0.0093	0.0143	0.0344
9	Yakima	WA	0.0053	0.0003	0.0104	0.0049	0.0047	0.0284
10	Cheyenne	WY	0.0053	0.0003	0.0140	0.0014	0.0003	0.0071
11	Lander	WY	0.0058	0.0008	0.0544	0.0042	0.0012	0.0200
12	Los Angeles	CA	0.0792	0.1331	0.1885	0.0000	0.0556	0.0718
13	Sacramento	CA	0.0699	0.1509	0.1991	0.0000	0.0556	0.0718
14	San Diego	CA	0.0361	0.0658	0.0658	0.0000	0.0556	0.0718
15	Santa Maria	CA	0.0856	0.1234	0.1732	0.0000	0.0556	0.0718
16	Ely	NV	0.0056	0.0135	0.0752	0.0059	0.0011	0.0036
17	Rapid City	SD	0.0053	0.0003	0.0102	0.0010	0.0011	0.0192
18	Cedar City	UT	0.0056	0.0003	0.0259	0.0048	0.0008	0.0053
19	Albuquerque	NM	0.0056	0.0003	0.0097	0.0016	0.0151	0.0074
20	Las Vegas	NV	0.0206	0.0231	0.0556	0.0052	0.0018	0.0080
21	Phoenix	AZ	0.0053	0.0003	0.0351	0.0047	0.0020	0.0008
22	Tucson	AZ	0.0064	0.0003	0.0279	0.0064	0.0075	0.0017
23	El Paso	TX	0.0053	0.0003	0.0330	0.0058	0.0026	0.0067
24	Medford	OR	0.2261	0.2497	0.2990	0.1262	0.1328	0.1313
25	Great Falls	MT	0.0132	0.0259	0.0899	0.0019	0.0047	0.0334
26	Salt Lake City	UT	0.0091	0.0193	0.0747	0.0091	0.0105	0.0368
27	Grand Island	NE	0.0284	0.0963	0.2050	0.0422	0.1347	0.1342
28	Flagstaff	AZ	0.0170	0.0404	0.1016	0.0105	0.1228	0.1234
29	Dodge City	KS	0.0295	0.1011	0.1902	0.0033	0.1063	0.1193
30	Midland	TX	0.0381	0.0757	0.1283	0.0033	0.1063	0.1193

Climate Center Index	Climate Center		No Liner Infiltration Rate (m/yr)			Single Clay Liner Infiltration Rate (m/yr)		
	City	State	Low	Med	High	Low	Med	High
			Silt Loam	Sandy Loam	Silty Clay	Silt Loam	Sandy Loam	Silty Clay Loam
31	St. Cloud	MN	0.0513	0.1516	0.2418	0.0264	0.1262	0.1255
32	E. Lansing	MI	0.0602	0.1361	0.2197	0.0481	0.1153	0.1114
33	North Omaha	NE	0.0439	0.1618	0.2771	0.0202	0.1264	0.1265
34	Tulsa	OK	0.0907	0.2471	0.3452	0.0050	0.1329	0.1318
35	Brownsville	TX	0.0457	0.2268	0.3256	0.0050	0.1329	0.1318
36	Dallas	TX	0.1067	0.2578	0.3543	0.0050	0.1329	0.1318
37	Oklahoma City	OK	0.0851	0.2423	0.3386	0.0075	0.1310	0.1298
38	Concord	NH	0.1410	0.2570	0.3147	0.1125	0.1273	0.1266
39	Pittsburg	PA	0.1100	0.2131	0.2944	0.1125	0.1273	0.1266
40	Portland	OR	0.1003	0.1880	0.2705	0.1125	0.1273	0.1266
41	Caribou	ME	0.1016	0.1758	0.2372	0.1125	0.1273	0.1266
42	Chicago	IL	0.1158	0.2126	0.2725	0.1125	0.1273	0.1266
43	Burlington	VT	0.4663	0.5331	0.5631	0.1125	0.1273	0.1266
44	Bangor	ME	0.0820	0.1717	0.2852	0.1125	0.1273	0.1266
45	Rutland	VT	0.4486	0.5060	0.5370	0.1125	0.1273	0.1266
46	Seattle	WA	0.0485	0.1676	0.2685	0.1125	0.1273	0.1266
47	Montpelier	VT	0.1252	0.2098	0.3160	0.1125	0.1273	0.1266
48	Sault St. Marie	MI	0.1283	0.2116	0.2858	0.1125	0.1273	0.1266
49	Put-in-Bay	OH	0.0617	0.2022	0.3048	0.0688	0.1325	0.1321
50	Madison	WI	0.0790	0.1717	0.2606	0.0688	0.1325	0.1321
51	Columbus	OH	0.0559	0.1481	0.2527	0.0688	0.1325	0.1321
52	Cleveland	OH	0.0889	0.1821	0.2680	0.0688	0.1325	0.1321
53	Des Moines	IA	0.1232	0.2634	0.3907	0.0688	0.1325	0.1321
54	E. St. Louis	IL	0.0897	0.2512	0.3546	0.0688	0.1325	0.1321
55	Columbia	MO	0.1547	0.3101	0.4277	0.0688	0.1325	0.1321
56	Topeka	KS	0.0841	0.2469	0.3620	0.0174	0.1305	0.1302
57	Tampa	FL	0.1168	0.2954	0.4026	0.0200	0.1339	0.1333
58	San Antonio	TX	0.1059	0.2715	0.3724	0.0200	0.1339	0.1333
59	Hartford	CT	0.1496	0.2611	0.3444	0.1193	0.1286	0.1279
60	Syracuse	NY	0.2487	0.4100	0.4844	0.1193	0.1286	0.1279
61	Worchester	MA	0.1473	0.2751	0.3622	0.1193	0.1286	0.1279

Climate Center Index	Climate Center		No Liner Infiltration Rate (m/yr)			Single Clay Liner Infiltration Rate (m/yr)		
	City	State	Low	Med	High	Low	Med	High
			Silt Loam	Sandy Loam	Silty Clay	Silt Loam	Sandy Loam	Silty Clay Loam
62	Augusta	ME	0.1692	0.3216	0.4209	0.1193	0.1286	0.1279
63	Providence	RI	0.1821	0.3482	0.4610	0.1193	0.1286	0.1279
64	Portland	ME	0.1765	0.3335	0.4148	0.1193	0.1286	0.1279
65	Nashua	NH	0.1773	0.3312	0.4267	0.1193	0.1286	0.1279
66	Ithaca	NY	0.1806	0.3132	0.3861	0.1193	0.1286	0.1279
67	Boston	MA	0.2090	0.3254	0.3922	0.1193	0.1286	0.1279
68	Schenectady	NY	0.1770	0.2786	0.3622	0.1193	0.1286	0.1279
69	Lynchburg	VA	0.2830	0.4590	0.5654	0.1062	0.1336	0.1332
70	New York City	NY	0.1234	0.2690	0.3818	0.1062	0.1336	0.1332
71	Philadelphia	PA	0.1577	0.3406	0.4709	0.1062	0.1336	0.1332
72	Seabrook	NJ	0.1783	0.3096	0.4133	0.1062	0.1336	0.1332
73	Indianapolis	IN	0.2121	0.3988	0.5184	0.1062	0.1336	0.1332
74	Cincinnati	OH	0.1773	0.3526	0.4757	0.1062	0.1336	0.1332
75	Bridgeport	CT	0.2113	0.3691	0.4717	0.1062	0.1336	0.1332
76	Orlando	FL	0.3061	0.4839	0.5941	0.0804	0.1273	0.1266
77	Greensboro	NC	0.2426	0.4666	0.5903	0.0804	0.1273	0.1266
78	Jacksonville	FL	0.2591	0.4455	0.5710	0.0804	0.1273	0.1266
79	Watkinsville	GA	0.2992	0.4544	0.5535	0.0804	0.1273	0.1266
80	Norfolk	VA	0.1694	0.3835	0.4737	0.0804	0.1273	0.1266
81	Shreveport	LA	0.1996	0.4087	0.5263	0.0804	0.1273	0.1266
82	Astoria	OR	0.9865	1.2136	1.2637	0.1316	0.1355	0.1350
83	New Haven	CT	0.3561	0.5423	0.5098	0.1316	0.1355	0.1350
84	Plainfield	MA	0.1910	0.3033	0.3950	0.1316	0.1355	0.1350
85	Knoxville	TN	0.2804	0.4521	0.5733	0.1255	0.1352	0.1349
86	Central Park	NY	0.3045	0.4897	0.6066	0.1255	0.1352	0.1349
87	Lexington	KY	0.4039	0.5415	0.6421	0.1255	0.1352	0.1349
88	Edison	NJ	0.3000	0.5286	0.6525	0.1255	0.1352	0.1349
89	Nashville	TN	0.4173	0.6144	0.7435	0.1255	0.1352	0.1349
90	Little Rock	AK	0.3332	0.5288	0.6414	0.1184	0.1351	0.1347
91	Tallahassee	FL	0.5024	0.8486	0.9792	0.1184	0.1351	0.1347
92	New Orleans	LA	0.3018	0.5380	0.6683	0.1184	0.1351	0.1347
93	Charleston	SC	0.2794	0.4829	0.5832	0.1184	0.1351	0.1347

Climate Center Index	Climate Center		No Liner Infiltration Rate (m/yr)			Single Clay Liner Infiltration Rate (m/yr)		
	City	State	Low	Med	High	Low	Med	High
			Silt Loam	Sandy Loam	Silty Clay	Silt Loam	Sandy Loam	Silty Clay Loam
94	W. Palm Beach	FL	0.5126	0.8219	0.9581	0.1184	0.1351	0.1347
95	Atlanta	GA	0.2553	0.5641	0.6904	0.1184	0.1351	0.1347
96	Lake Charles	LA	0.1615	0.4227	0.5331	0.0489	0.0558	0.0927
97	Miami	FL	0.3891	0.6066	0.7201	0.0489	0.0558	0.0927
98	Annette	AK	1.5373	1.8146	1.8789	0.1352	0.1357	0.1354
99	Bethel	AK	0.0502	0.0725	0.1225	0.0352	0.0364	0.0660
100	Fairbanks	AK	0.0077	0.0167	0.0777	0.0098	0.0118	0.0407
101	Honolulu	HI	0.0501	0.1083	0.1983	0.0323	0.0494	0.0871
102	San Juan	PR	0.1498	0.2883	0.4442	0.0637	0.0793	0.1114

Table A.13 HELP-derived Land Application Unit Infiltration Rates

Climate Center Index	Climate Center		No Liner Infiltration Rate (m/yr)		
	City	State	Silt Loam	Sandy Loam	Silty Clay Loam
1	Fresno	CA	0.0307	0.0368	0.0381
2	Boise	ID	0.0008	0.0094	0.0038
3	Denver	CO	0.0008	0.0008	0.0036
4	Grand Junction	CO	0.0000	0.0000	0.0003
5	Pocatello	ID	0.0000	0.0000	0.0000
6	Glasgow	MT	0.0099	0.0074	0.0099
7	Bismarck	ND	0.0239	0.0300	0.0196
8	Pullman	WA	0.0069	0.0132	0.0084
9	Yakima	WA	0.0000	0.0023	0.0003
10	Cheyenne	WY	0.0005	0.0013	0.0086
11	Lander	WY	0.0033	0.0053	0.0094
12	Los Angeles	CA	0.0787	0.0950	0.0699
13	Sacramento	CA	0.1024	0.0876	0.0945
14	San Diego	CA	0.0221	0.0340	0.0241
15	Santa Maria	CA	0.0947	0.1151	0.0841
16	Ely	NV	0.0000	0.0000	0.0003
17	Rapid City	SD	0.0005	0.0071	0.0033
18	Cedar City	UT	0.0000	0.0008	0.0000
19	Albuquerque	NM	0.0000	0.0000	0.0003
20	Las Vegas	NV	0.0000	0.0000	0.0018
21	Phoenix	AZ	0.0000	0.0003	0.0003
22	Tucson	AZ	0.0000	0.0003	0.0005
23	El Paso	TX	0.0076	0.0130	0.0081
24	Medford	OR	0.2073	0.2309	0.2096
25	Great Falls	MT	0.0036	0.0069	0.0074
26	Salt Lake City	UT	0.0130	0.0269	0.0185
27	Grand Island	NE	0.0442	0.0627	0.0323
28	Flagstaff	AZ	0.0239	0.0630	0.0226
29	Dodge City	KS	0.0135	0.0345	0.0226
30	Midland	TX	0.0180	0.0254	0.0135
31	St. Cloud	MN	0.0602	0.0831	0.0554
32	E. Lansing	MI	0.1090	0.1452	0.1102
33	North Omaha	NE	0.0671	0.0795	0.0536
34	Tulsa	OK	0.0686	0.1006	0.0465
35	Brownsville	TX	0.0549	0.1049	0.0384

Climate Center Index	Climate Center		No Liner Infiltration Rate (m/yr)		
	City	State	Silt Loam	Sandy Loam	Silty Clay Loam
36	Dallas	TX	0.0599	0.1067	0.0531
37	Oklahoma City	OK	0.0612	0.0942	0.0389
38	Concord	NH	0.1585	0.2057	0.1372
39	Pittsburg	PA	0.0894	0.1313	0.0792
40	Portland	OR	0.4171	0.4387	0.3927
41	Caribou	ME	0.1082	0.1491	0.0886
42	Chicago	IL	0.0798	0.1138	0.0620
43	Burlington	VT	0.1359	0.1781	0.1166
44	Bangor	ME	0.1471	0.2045	0.1227
45	Rutland	VT	0.1212	0.1598	0.1008
46	Seattle	WA	0.4384	0.4582	0.4077
47	Montpelier	VT	0.1062	0.1483	0.0879
48	Sault St. Marie	MI	0.1651	0.2101	0.1435
49	Put-in-Bay	OH	0.0508	0.1003	0.0495
50	Madison	WI	0.0912	0.1400	0.0686
51	Columbus	OH	0.0765	0.1158	0.0663
52	Cleveland	OH	0.0780	0.1212	0.0823
53	Des Moines	IA	0.1143	0.1641	0.1156
54	E. St. Louis	IL	0.1435	0.1676	0.0704
55	Columbia	MO	0.1529	0.1989	0.1224
56	Topeka	KS	0.1049	0.1483	0.0762
57	Tampa	FL	0.0658	0.1031	0.0475
58	San Antonio	TX	0.1095	0.1646	0.0820
59	Hartford	CT	0.1709	0.2228	0.1405
60	Syracuse	NY	0.2545	0.3251	0.2118
61	Worchester	MA	0.2022	0.2591	0.1697
62	Augusta	ME	0.2116	0.2700	0.1674
63	Providence	RI	0.2131	0.2863	0.1753
64	Portland	ME	0.2294	0.2840	0.1872
65	Nashua	NH	0.2268	0.2812	0.1943
66	Ithaca	NY	0.1684	0.2136	0.1392
67	Boston	MA	0.2332	0.2383	0.1542
68	Schenectady	NY	0.1473	0.1928	0.1224
69	Lynchburg	VA	0.3081	0.3612	0.2570
70	New York City	NY	0.2436	0.2944	0.1969
71	Philadelphia	PA	0.2007	0.2609	0.1641
72	Seabrook	NJ	0.1814	0.2428	0.1427

Climate Center Index	Climate Center		No Liner Infiltration Rate (m/yr)		
	City	State	Silt Loam	Sandy Loam	Silty Clay Loam
73	Indianapolis	IN	0.1300	0.1862	0.1064
74	Cincinnati	OH	0.1554	0.2210	0.1539
75	Bridgeport	CT	0.1953	0.2464	0.1615
76	Orlando	FL	0.1016	0.1697	0.0805
77	Greensboro	NC	0.3256	0.3896	0.2705
78	Jacksonville	FL	0.1511	0.2106	0.1102
79	Watkinsville	GA	0.2891	0.3556	0.2332
80	Norfolk	VA	0.3122	0.0000	0.2685
81	Shreveport	LA	0.2296	0.2939	0.1842
82	Astoria	OR	1.0762	1.1494	0.9647
83	New Haven	CT	0.3520	0.4628	0.2855
84	Plainfield	MA	0.1900	0.2540	0.1521
85	Knoxville	TN	0.4107	0.4460	0.3543
86	Central Park	NY	0.3363	0.4171	0.2738
87	Lexington	KY	0.3294	0.3970	0.2700
88	Edison	NJ	0.3122	0.3914	0.2492
89	Nashville	TN	0.4674	0.5395	0.3769
90	Little Rock	AK	0.3531	0.4336	0.2824
91	Tallahassee	FL	0.5913	0.7308	0.4564
92	New Orleans	LA	0.5893	0.7445	0.4503
93	Charleston	SC	0.2609	0.3287	0.2123
94	W. Palm Beach	FL	0.2611	0.3490	0.1783
95	Atlanta	GA	0.3416	0.3993	0.2822
96	Lake Charles	LA	0.3647	0.4641	0.2817
97	Miami	FL	0.1450	0.2201	0.1019
98	Annette	AK	1.8049	1.9771	1.5159
99	Bethel	AK	0.1849	0.1981	0.1781
100	Fairbanks	AK	0.1463	0.1483	0.1445
101	Honolulu	HI	0.0541	0.0983	0.0363
102	San Juan	PR	0.1491	0.2164	0.1049

Table A.14 HELP-derived Regional Recharge Rates

Climate Center Index	Climate Center		Ambient Regional Recharge Rate (m/yr)		
			Soil Type		
	City	State	Silt Loam	Sandy Loam	Silty Clay Loam
1	Fresno	CA	0.0307	0.0368	0.0381
2	Boise	ID	0.0008	0.0094	0.0038
3	Denver	CO	0.0008	0.0008	0.0036
4	Grand Junction	CO	0.0000	0.0000	0.0003
5	Pocatello	ID	0.0000	0.0000	0.0000
6	Glasgow	MT	0.0099	0.0074	0.0099
7	Bismarck	ND	0.0239	0.0300	0.0196
8	Pullman	WA	0.0069	0.0132	0.0084
9	Yakima	WA	0.0000	0.0023	0.0003
10	Cheyenne	WY	0.0005	0.0013	0.0086
11	Lander	WY	0.0033	0.0053	0.0094
12	Los Angeles	CA	0.0787	0.0950	0.0699
13	Sacramento	CA	0.1024	0.0876	0.0945
14	San Diego	CA	0.0221	0.0340	0.0241
15	Santa Maria	CA	0.0947	0.1151	0.0841
16	Ely	NV	0.0000	0.0000	0.0003
17	Rapid City	SD	0.0005	0.0071	0.0033
18	Cedar City	UT	0.0000	0.0008	0.0000
19	Albuquerque	NM	0.0000	0.0000	0.0003
20	Las Vegas	NV	0.0000	0.0000	0.0018
21	Phoenix	AZ	0.0000	0.0003	0.0003
22	Tucson	AZ	0.0000	0.0003	0.0005
23	El Paso	TX	0.0076	0.0130	0.0081
24	Medford	OR	0.2073	0.2309	0.2096
25	Great Falls	MT	0.0036	0.0069	0.0074
26	Salt Lake City	UT	0.0130	0.0269	0.0185
27	Grand Island	NE	0.0442	0.0627	0.0323
28	Flagstaff	AZ	0.0239	0.0630	0.0226
29	Dodge City	KS	0.0135	0.0345	0.0226
30	Midland	TX	0.0180	0.0254	0.0135
31	St. Cloud	MN	0.0602	0.0831	0.0554
32	E. Lansing	MI	0.1090	0.1452	0.1102
33	North Omaha	NE	0.0671	0.0795	0.0536
34	Tulsa	OK	0.0686	0.1006	0.0465
35	Brownsville	TX	0.0549	0.1049	0.0384

Climate Center Index	Climate Center		Ambient Regional Recharge Rate (m/yr)		
			Soil Type		
	City	State	Silt Loam	Sandy Loam	Silty Clay Loam
36	Dallas	TX	0.0599	0.1067	0.0531
37	Oklahoma City	OK	0.0612	0.0942	0.0389
38	Concord	NH	0.1585	0.2057	0.1372
39	Pittsburg	PA	0.0894	0.1313	0.0792
40	Portland	OR	0.4171	0.4387	0.3927
41	Caribou	ME	0.1082	0.1491	0.0886
42	Chicago	IL	0.0798	0.1138	0.0620
43	Burlington	VT	0.1359	0.1781	0.1166
44	Bangor	ME	0.1471	0.2045	0.1227
45	Rutland	VT	0.1212	0.1598	0.1008
46	Seattle	WA	0.4384	0.4582	0.4077
47	Montpelier	VT	0.1062	0.1483	0.0879
48	Sault St. Marie	MI	0.1651	0.2101	0.1435
49	Put-in-Bay	OH	0.0508	0.1003	0.0495
50	Madison	WI	0.0912	0.1400	0.0686
51	Columbus	OH	0.0765	0.1158	0.0663
52	Cleveland	OH	0.0780	0.1212	0.0823
53	Des Moines	IA	0.1143	0.1641	0.1156
54	E. St. Louis	IL	0.1435	0.1676	0.0704
55	Columbia	MO	0.1529	0.1989	0.1224
56	Topeka	KS	0.1049	0.1483	0.0762
57	Tampa	FL	0.0658	0.1031	0.0475
58	San Antonio	TX	0.1095	0.1646	0.0820
59	Hartford	CT	0.1709	0.2228	0.1405
60	Syracuse	NY	0.2545	0.3251	0.2118
61	Worchester	MA	0.2022	0.2591	0.1697
62	Augusta	ME	0.2116	0.2700	0.1674
63	Providence	RI	0.2131	0.2863	0.1753
64	Portland	ME	0.2294	0.2840	0.1872
65	Nashua	NH	0.2268	0.2812	0.1943
66	Ithaca	NY	0.1684	0.2136	0.1392
67	Boston	MA	0.2332	0.2383	0.1542
68	Schenectady	NY	0.1473	0.1928	0.1224
69	Lynchburg	VA	0.3081	0.3612	0.2570
70	New York City	NY	0.2436	0.2944	0.1969
71	Philadelphia	PA	0.2007	0.2609	0.1641

Climate Center Index	Climate Center		Ambient Regional Recharge Rate (m/yr)		
			Soil Type		
	City	State	Silt Loam	Sandy Loam	Silty Clay Loam
72	Seabrook	NJ	0.1814	0.2428	0.1427
73	Indianapolis	IN	0.1300	0.1862	0.1064
74	Cincinnati	OH	0.1554	0.2210	0.1539
75	Bridgeport	CT	0.1953	0.2464	0.1615
76	Orlando	FL	0.1016	0.1697	0.0805
77	Greensboro	NC	0.3256	0.3896	0.2705
78	Jacksonville	FL	0.1511	0.2106	0.1102
79	Watkinsville	GA	0.2891	0.3556	0.2332
80	Norfolk	VA	0.3122	0.0000	0.2685
81	Shreveport	LA	0.2296	0.2939	0.1842
82	Astoria	OR	1.0762	1.1494	0.9647
83	New Haven	CT	0.3520	0.4628	0.2855
84	Plainfield	MA	0.1900	0.2540	0.1521
85	Knoxville	TN	0.4107	0.4460	0.3543
86	Central Park	NY	0.3363	0.4171	0.2738
87	Lexington	KY	0.3294	0.3970	0.2700
88	Edison	NJ	0.3122	0.3914	0.2492
89	Nashville	TN	0.4674	0.5395	0.3769
90	Little Rock	AK	0.3531	0.4336	0.2824
91	Tallahassee	FL	0.5913	0.7308	0.4564
92	New Orleans	LA	0.5893	0.7445	0.4503
93	Charleston	SC	0.2609	0.3287	0.2123
94	W. Palm Beach	FL	0.2611	0.3490	0.1783
95	Atlanta	GA	0.3416	0.3993	0.2822
96	Lake Charles	LA	0.3647	0.4641	0.2817
97	Miami	FL	0.1450	0.2201	0.1019
98	Annette	AK	1.6833	1.8354	1.4610
99	Bethel	AK	0.0564	0.0721	0.0554
100	Fairbanks	AK	0.0104	0.0234	0.0117
101	Honolulu	HI	0.0523	0.0945	0.0366
102	San Juan	PR	0.1267	0.1923	0.0945

A.1.5 DETERMINATION OF RECHARGE RATES

We estimated recharge rates for the three primary soil types across the United States (SLN, SLT, and SCL) and ambient climate conditions at 102 climate

stations through the use of the HELP water-balance model as summarized in Sections A.1.1 and A.1.2. We assumed the ambient regional recharge rate for a given climate center and soil type (for all four WMU types) is the same as the corresponding unlined LF infiltration rate. Table A.14 presents the resulting regional recharge rates for all climate stations and soil types.

A.2 REFERENCES

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APPENDIX B

NON-LINEAR SORPTION ISOTHERMS CALCULATED USING THE MINTEQA2 MODEL

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APPENDIX B

NON-LINEAR SORPTION ISOTHERMS CALCULATED USING THE MINTEQA2 MODEL

1.0 INTRODUCTION

This appendix describes the development of concentration-dependent metal partition coefficients for use in EPACMTP. In the subsurface, metal contaminants undergo reactions with ligands in the pore water and with surface sites on the solid aquifer or soil matrix material. Reactions in which the metal is bound to the solid matrix are referred to as sorption reactions and metal that is bound to the solid is said to be sorbed. The ratio of the concentration of metal sorbed to the concentration in the mobile aqueous phase at equilibrium is referred to as the partition coefficient (K_d). During contaminant transport, sorption to the solid matrix results in retardation of the contaminant front. Thus, transport models such as EPACMTP incorporate the contaminant partition coefficient into the overall retardation factor (the ratio of the average linear particle velocity to the velocity of that portion of the plume where the contaminant is at 50 percent dilution). Using K_d in EPACMTP transport modeling implies the assumption that local equilibrium between the solutes and the sorbents is attained. This implies that the rate of sorption reactions is fast relative to advective-dispersive transport of the contaminant.

EPACMTP incorporates the option of using tables of non-linear sorption isotherms. These isotherms reflect the tendency of K_d to decrease as the total metal concentration in the system increases. The non-linear isotherms available for use in EPACMTP are specified in terms of the dissolved metal concentration and the corresponding sorbed concentration at a series of total metal concentrations. The isotherms were estimated using the geochemical speciation model, MINTEQA2. For a particular metal, K_d values in a soil or aquifer are dependent upon the metal concentration and various geochemical characteristics of the soil or aquifer and the associated pore water. Geochemical parameters that have the greatest influence on the magnitude of K_d include the pH of the system and the nature and concentration of sorbents associated with the soil or aquifer matrix. In the subsurface beneath a disposal facility, the concentration of leachate constituents may also influence K_d . Although the dependence of metal partitioning on the total metal concentration and on pH and other geochemical characteristics is apparent from partitioning studies reported in the scientific literature, K_d values for many metals are not available for the range of metal concentrations or geochemical conditions needed in risk assessment modeling. For this reason, we chose to use an equilibrium speciation model, MINTEQA2, to estimate partition coefficients. Using a speciation model allows K_d values to be estimated for a range of total metal concentrations in various model systems designed to depict natural variability in those geochemical characteristics that most influence metal partitioning.

MINTEQA2

We produced the non-linear sorption isotherms for metals by using MINTEQA2¹, a geochemical speciation model maintained and distributed by the U.S. EPA. From input data consisting of total concentrations of chemical constituents, MINTEQA2 calculates the fraction of a contaminant metal that is dissolved, adsorbed, and precipitated at equilibrium (see Figure B.1). The total concentrations of major and minor ions, trace metals and other chemicals are specified in terms of key species known as components. MINTEQA2 automatically includes an extensive database of solution species and solid phase species representing reaction products of two or more of the components. The model does not automatically include sorption reactions, but these can be included in the calculations if supplied by the user. When sorption reactions are included, the dimensionless partition coefficient can be calculated from the ratio of the sorbed metal concentration to the dissolved metal concentration at equilibrium. The dimensionless partition coefficient is converted to K_d with units of liters per kilogram (L/kg) by normalizing by the mass of soil (in kilograms) with which one liter of pore water is equilibrated (the phase ratio). An isotherm is generated when the equilibrium metal distribution between sorbed and dissolved fractions is estimated for a series of total metal concentrations.

Progress in accounting for sorption in equilibrium calculations over the past decade has resulted in the development of coherent databases of sorption reactions for particular sorbents. These databases include acid-base sorption reactions and reactions for major ions in aquatic systems (Ca, Mg, SO₄, etc.). Including such reactions along with those representing sorption of trace metals makes it possible to estimate sorption in systems of varying pH and composition. Examples of coherent databases of sorption reactions include that for the hydrous ferric oxide surface presented by Dzombak and Morel (1990) and a similar database for goethite presented by Mathur (1995).

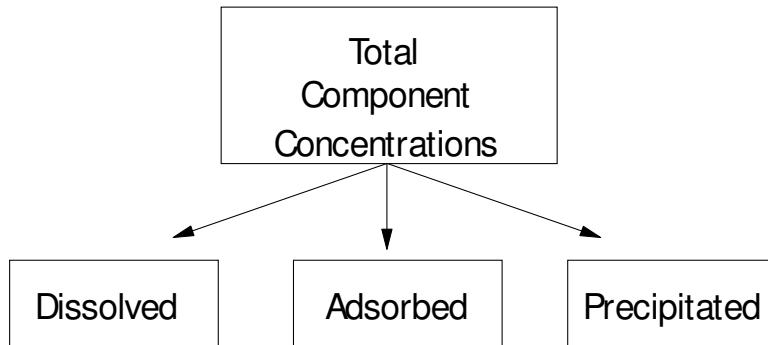


Figure B.1 MINTEQA2 Computes the Equilibrium Distribution of Metal.

¹ The version of MINTEQA2 used in this modeling was modified from version 4.02.

2.0 MODEL INPUT DATA AND PROCEDURE

Expected natural variability in K_d for a particular metal was included in the MINTEQA2 modeling by including variability in important input parameters upon which K_d depends. The input parameters for which variability was incorporated include ground-water composition, pH, concentration of sorbents, concentration of leachate organic matter (LOM), and concentration of metal.

The ground-water chemistry exerts an important influence on metal partition coefficients. The major ions present in ground water may compete with trace metals for sorption sites. Also, inorganic ligands may complex with some metals reducing their tendency to sorb. For the purposes of this model, we assumed that the influence of ground-water composition on metal sorption can be adequately represented by dividing the universe of ground-water compositional types into two categories: carbonate and non-carbonate. Further, we assumed that the influence of pH can be represented by depicting each of these two ground water types at a number of equilibrium pH values within its natural range of variability. Furthermore, the depiction of each ground-water chemistry at multiple pH values can be accomplished by titrating the natural ground-water chemistry with a mineral acid or base.

The influence of variability in sorption capacity of soil and aquifer materials was included in the K_d estimates by equilibrating the ground-water systems with various concentrations of commonly occurring natural sorbents. Two common sorbents in soil and ground-water systems are ferric oxyhydroxide and particulate organic matter (POM). Although other sorbents such as clay minerals, carbonate minerals, hydrous aluminum and manganese oxides, and silica may sorb metals in the subsurface, representation of ferric oxyhydroxide and particulate organic matter in the model is sufficient to provide a reasonable assessment of the sorption capacity of most natural ground-water systems.

Leachate organic matter present as various well-characterized acids may influence the propensity for metal sorption. The influence of leachate organic matter on metal sorption is characterized by including representative acids present at concentration levels that span the expected range.

2.1 METALS OF INTEREST

The metal contaminants whose partition coefficients have been estimated using MINTEQA2 include arsenic (As), antimony (Sb), barium (Ba), beryllium (Be), cadmium (Cd), cobalt (Co), copper (Cu), chromium (Cr), fluoride (F), mercury (Hg), manganese (Mn), molybdenum (Mo), lead (Pb), nickel (Ni), selenium (Se), silver (Ag), thallium (Tl), vanadium (V), and zinc (Zn).

Several of these metals occur naturally in more than one oxidation state. The modeling described here is restricted to the oxidation states that are most likely to occur in waste systems or most likely to be mobile in ground-water waste systems. For arsenic, chromium, and selenium, partition coefficients were estimated for two oxidation

states. These were: As(III) and As(V), Cr(III) and Cr(VI), and Se(IV) and Se(VI). For antimony, molybdenum, thallium, and vanadium, only one oxidation state was modeled although multiple oxidation states occur. For all four of these metals, the choice of which state to model was dictated by practical aspects such as availability of sorption reactions and by subjective assessment of the appropriate oxidation state. The oxidation states modeled were Sb(V) (there were no sorption reactions available for Sb(III)), Mo(VI) (molybdate seems the most relevant form from literature reports), thallium (I) (this form is more frequently cited in the literature as having environmental implications), and V(V) (vanadate; sorption reactions were not available for other forms).

2.2 GROUND-WATER COMPOSITION

The extent of metal sorption in a ground-water system is dependent upon the chemical characteristics of the pore water solution and the interactions between all solutes and the sorbing sites present on the exposed surfaces of the soil and aquifer matrix material. In EPACMTP, partition coefficients were estimated separately for two ground-water compositional types, one with composition representative of a carbonate-terrain system and one representative of a non-carbonate system. The two ground-water compositional types are correlated with the hydrogeologic environment parameter in EPACMTP. In EPACMTP, this parameter may take on one of thirteen values, each indicative of a particular ground-water type (see Table B.1). Issues of practicality limit to just two the number of ground-water types for which separate partition coefficients can be estimated. The broadest division that may be made of the thirteen ground-water types in EPACMTP is carbonate and non-carbonate. Thus, these are the two broad types for which coefficients were estimated. The carbonate type corresponds to the “solution limestone” hydrogeologic environment setting in EPACMTP (hydrogeologic environment parameter = 12). The other twelve possible hydrogeologic settings in EPACMTP are represented by the non-carbonate ground-water type.

Table B.1 Settings For The Hydrogeologic Environment Parameter In EPACMTP

Hydrogeologic Environment Parameter	Environment (Ground-Water Type) Represented
1	Metamorphic and Igneous
2	Bedded Sedimentary Rock
3	Till Over Sedimentary Rock
4	Sand and Gravel
5	Alluvial Basins Valleys and Fans
6	River Valleys and Floodplains with Overbank Deposits
7	River Valleys and Floodplains without Overbank Deposit
8	Outwash
9	Till and Till Over Outwash
10	Unconsolidated and Semi-consolidated Shallow Aquifers
11	Coastal Beaches
12	Solution Limestone
13	Others (unclassified hydrogeologic environments)

For both ground-water types, we selected from the literature a representative, charge-balanced ground-water chemistry specified in terms of major ion concentrations and natural pH. The carbonate system was represented by a well sample reported for a limestone aquifer (Freeze and Cherry, 1979). This ground water had a natural pH of 7.5 and was saturated with respect to calcite. The non-carbonate system was represented by a sample reported from an unconsolidated sand and gravel aquifer with a natural pH of 7.4 (White et al., 1963). An unconsolidated sand and gravel aquifer was selected to represent the non-carbonate compositional type because it is the most frequently occurring of the twelve (non-carbonate) hydrogeologic environments in EPACMTP. The composition of both the carbonate and non-carbonate representative ground-water samples is shown in Table B.2. These compositions were used in MINTEQA2 to estimate partition coefficients for carbonate and non-carbonate ground-water types. When EPACMTP is used in site-specific or monte carlo mode, the choice of the hydrogeologic environment by the user (or the monte carlo routine) dictates the set of partition coefficients (carbonate or non-carbonate) that should be accessed.

Table B.2 Composition Of Representative Ground Waters

Constituent Chemical	Concentrations (mg/L)	
	Carbonate Ground water	Non-carbonate Ground water
Ca	55	49
Mg	28	13
SO ₄	20	27
HCO ₃	265	384
Na	3.1	105
Cl	10	34
K	1.5	3.0
NO ₃	---	7.8
F	---	0.3
SiO ₂	---	21
pH	7.5	7.4
Temp	18 C	14 C
Other	Equilibrium with calcite	---

2.3 MODEL ADSORBENTS

Two types of adsorbents were represented in the MINTEQA2 equilibrium modeling: ferric oxide and particulate organic matter. Ferric oxides (and hydroxides) and particulate organic matter are among the most important sorbents in natural systems. The former may be present as amorphous substances or crystalline minerals such as hematite, goethite, or ferrihydrite dispersed in soil as discrete particles or as coatings on particles of other materials. In recent years, databases of equilibrium sorption reactions for hydrous ferric oxide and goethite have been compiled from studies described in the literature (Dzombak and Morel, 1990; Mathur, 1995). Both of the databases cited were designed for use with the MIT Two-Layer sorption model, also called the diffuse-layer model (DLM; Dzombak and Morel, 1990).

Owing to the complexity and variability of natural organic substances, the science of modeling surface reactions on particulate organic matter is less advanced than for sorption onto hydrous metal oxides. The modeling described here assumes that reactions on POM are analogous to those on dissolved organic matter (DOM); a DOM model was adapted for the POM calculation. This model, the Gaussian distribution model (Dobbs et. al., 1989), assumes that organic matter is a complex mixture of substances exhibiting highly variable binding affinities for metals. Reactions are represented like conventional pure substance reactions except that the usual single equilibrium constant is replaced by a distribution of constants (log K values). The distribution of log K is assumed to be Gaussian in shape. This model is also supplied with a database of reactions, including acid-base and major ion reactions, each with its mean log K for depicting the Gaussian distribution.

When included in equilibrium models, these databases of sorption reactions provide a means of including competition for sorption sites among major ground-water ions such as Ca, Mg, and SO₄ and contaminant metal constituents. More importantly, by including in equilibrium calculations the acid-base reactions for these surfaces, the dependence of trace metal sorption on pH can be reflected in the model.

2.3.1 Goethite Sorbent

Mineralogically, we assumed the ferric oxide sorbent to be goethite (α -FeOOH). Goethite is a common form of ferric oxide in soils. The database of sorption reactions for goethite reported by Mathur (1995) was used with the diffuse-layer sorption model in MINTEQA2 to represent the interactions of protons, major ions, and contaminant metals with the ferric oxide surface (hereafter referred to as FeOx for brevity).

The concentration of sorption sites used in the MINTEQA2 model runs was based on a measurement of ferric iron extractable from soil samples using hydroxylamine hydrochloride as reported in EPRI(1986). This method of Fe extraction is intended to provide a measure of the exposed ferric oxide present as mineral coatings and discrete particles and available for surface reactions with solutes in the associated pore water. The variability in ferric oxide sorbent concentration represented by the variability in extractable Fe from these samples was included in the modeling by selecting low, medium and high extractable Fe concentrations corresponding to the 17th, 50th and 83rd percentiles of the sample measurements. The extractable Fe weight percentages used in the modeling are shown in Table B.3.

Table B.3 Concentration Levels For Goethite Sorbent

Concentration Level	Weight Percent Fe (extractable)	FeOOH Sorbent Concentration (g/L)
<i>Unsaturated zone</i>		
Low	0.0182	1.325
Medium	0.0729	5.309
High	0.1190	8.667
<i>Saturated zone</i>		
Low	0.0182	1.032
Medium	0.0729	4.136
High	0.1190	6.751

Although the same distribution of extractable Fe sorbent was used in modeling the saturated and unsaturated zones, the actual concentration of sorbing sites corresponding to the low, medium, and high FeOx settings in MINTEQA2 was different in the two zones because the assumed ratio of soil mass to solution volume (the phase ratio) was different. For both zones, the phase ratio was calculated as the mean soil bulk density divided by the mean water content (product of mean porosity and mean water saturation). In EPACMTP, the mean soil bulk density and mean porosity are

1.6 kg/L and 45 percent, respectively. The mean water saturation in the unsaturated zone is 77.7 percent. The water saturation in the saturated zone is, of course, 100 percent. Thus, the phase ratio for the unsaturated zone is 4.57 kg/L and for the saturated zone is 3.56 kg/L. We used these values and the molar mass ratio of goethite to Fe to convert the weight percent extractable Fe to the mass of goethite appropriate for one liter of pore water solution (see Table B.3).

The specific surface area and site density used in the diffuse-layer adsorption model were as prescribed by Mathur(1995) for goethite. These values along with the molar concentration of FeOx sorbing sites are shown in Table B.4. The complete database of goethite sorption reactions used in MINTEQA2, including acid-base surface reactions and reactions for major ions, is shown in Table B.5. The reactions shown in Table B.5 have been reformulated for use in MINTEQA2. The reformulation step is necessary in order to present the reaction to MINTEQA2 in a manner consistent with its database conventions and its predetermined set of reactants (components). The MINTEQA2 conventions include the requirement that all reactions be written as formation reactions. In some cases, the reformulation may have involved adding ancillary reactions to those presented by Mathur. The addition of ancillary reactions is necessary if the original reaction is not written in terms of MINTEQA2 components. All ancillary reactions used to reformulate the Mathur goethite reactions were obtained directly from the MINTEQA2 (v4.02) thermodynamic database.

Table B.4 Model Parameters For The Goethite Sorbent

Parameter	Model Value
Specific surface area (m ² /g)	60
Site density (moles of sites per mole Fe)	0.018
<i>Unsaturated zone: Site concentration (mol/L)</i>	
Low	2.680x10 ⁻⁴
Medium	1.074x10 ⁻³
High	1.753x10 ⁻³
<i>Saturated zone: Site concentration (mol/L)</i>	
Low	2.087x10 ⁻⁴
Medium	8.365x10 ⁻⁴
High	1.365x10 ⁻³

Table B.5 Goethite Sorption Reactions Used In MINTEQA2

Goethite Sorption Reaction	Intrinsic Equilibrium Constant
$\equiv\text{FeOH}_2^+ \rightleftharpoons \equiv\text{FeOH}^\circ + \text{H}^+$	$\log K_{a1} = 6.93$
$\equiv\text{FeOH}^\circ \rightleftharpoons \equiv\text{FeO}^- + \text{H}^+$	$\log K_{a2} = -9.65$
$\equiv\text{FeOH}^\circ + \text{Ca}^{2+} \rightleftharpoons \equiv\text{FeOCa}^+ + \text{H}^+$	$\log K_1 = -6.48$
$\equiv\text{FeOH}^\circ + \text{Ca}^{2+} \rightleftharpoons \equiv\text{FeOHCa}^{2+}$	$\log K_2 = 3.98$
$\equiv\text{FeOH}^\circ + \text{Ca}^{2+} + \text{H}^+ \rightleftharpoons \equiv\text{FeOCa}^+ + \text{H}_2\text{O}$	$\log K_3 = 12.26$
$\equiv\text{FeOH}^\circ + \text{Mg}^{2+} \rightleftharpoons \equiv\text{FeOMg}^+ + \text{H}^+$	$\log K_1 = -3.02$
$\equiv\text{FeOH}^\circ + \text{Mg}^{2+} \rightleftharpoons \equiv\text{FeOHMg}^{2+}$	$\log K_2 = 5.24$
$\equiv\text{FeOH}^\circ + \text{Ba}^{2+} \rightleftharpoons \equiv\text{FeOBa}^+ + \text{H}^+$	$\log K_1 = -5.62$
$\equiv\text{FeOH}^\circ + \text{Ba}^{2+} \rightleftharpoons \equiv\text{FeOHBa}^{2+}$	$\log K_2 = 3.43$
$\equiv\text{FeOH}^\circ + \text{Cu}^{2+} \rightleftharpoons \equiv\text{FeOCu}^+ + \text{H}^+$	$\log K_1 = 1.39$
$\equiv\text{FeOH}^\circ + \text{Cu}^{2+} \rightleftharpoons \equiv\text{FeOHCu}^{2+}$	$\log K_2 = 8.92$
$\equiv\text{FeOH}^\circ + \text{Cd}^{2+} \rightleftharpoons \equiv\text{FeOCd}^+ + \text{H}^+$	$\log K_1 = -1.96$
$\equiv\text{FeOH}^\circ + \text{Cd}^{2+} \rightleftharpoons \equiv\text{FeOHCd}^{2+}$	$\log K_2 = 6.28$
$\equiv\text{FeOH}^\circ + \text{Zn}^{2+} \rightleftharpoons \equiv\text{FeOZn}^+ + \text{H}^+$	$\log K_1 = -0.96$
$\equiv\text{FeOH}^\circ + \text{Zn}^{2+} \rightleftharpoons \equiv\text{FeOHZn}^{2+}$	$\log K_2 = 7.50$
$\equiv\text{FeOH}^\circ + \text{Pb}^{2+} \rightleftharpoons \equiv\text{FeOPb}^+ + \text{H}^+$	$\log K_1 = 0.44$
$\equiv\text{FeOH}^\circ + \text{Pb}^{2+} \rightleftharpoons \equiv\text{FeOHPb}^{2+}$	$\log K_2 = 8.25$
$\equiv\text{FeOH}^\circ + \text{Ni}^{2+} \rightleftharpoons \equiv\text{FeONi}^+ + \text{H}^+$	$\log K_1 = -1.96$
$\equiv\text{FeOH}^\circ + \text{Ni}^{2+} \rightleftharpoons \equiv\text{FeOHNi}^{2+}$	$\log K_2 = 6.38$
$\equiv\text{FeOH}^\circ + \text{Co}^{2+} \rightleftharpoons \equiv\text{FeOCo}^+ + \text{H}^+$	$\log K_1 = -0.79$
$\equiv\text{FeOH}^\circ + \text{Co}^{2+} \rightleftharpoons \equiv\text{FeOHCo}^{2+}$	$\log K_2 = 7.28$
$\equiv\text{FeOH}^\circ + \text{Hg(OH)}_2^\circ \rightleftharpoons \equiv\text{FeOHgOH}^\circ + \text{H}_2\text{O}$	$\log K_0 = 2.86$
$\equiv\text{FeOH}^\circ + \text{Hg(OH)}_2^\circ + \text{H}^+ \rightleftharpoons \equiv\text{FeOHg}^+ + 2\text{H}_2\text{O}$	$\log K_1 = 10.03$
$\equiv\text{FeOH}^\circ + \text{Hg(OH)}_2^\circ + 2\text{H}^+ \rightleftharpoons \equiv\text{FeOHg}^{2+} + 2\text{H}_2\text{O}$	$\log K_2 = 18.58$
$\equiv\text{FeOH}^\circ + \text{Hg(OH)}_2^\circ + \text{H}^+ + \text{Cl}^- \rightleftharpoons \equiv\text{FeOHgCl}^\circ + 2\text{H}_2\text{O}$	$\log K_4 = 13.51$
$\equiv\text{FeOH}^\circ + \text{Ag}^+ \rightleftharpoons \equiv\text{FeOAg} + \text{H}^+$	$\log K_1 = -4.11$
$\equiv\text{FeOH}^\circ + \text{Ag}^+ \rightleftharpoons \equiv\text{FeOHAg}^+$	$\log K_2 = 4.74$
$\equiv\text{FeOH}^\circ + \text{Mn}^{2+} \rightleftharpoons \equiv\text{FeOMn}^+ + \text{H}^+$	$\log K_1 = -2.66$
$\equiv\text{FeOH}^\circ + \text{Mn}^{2+} \rightleftharpoons \equiv\text{FeOHMn}^{2+}$	$\log K_2 = 5.99$
$\equiv\text{FeOH}^\circ + \text{Be}^{2+} \rightleftharpoons \equiv\text{FeOBe}^+ + \text{H}^+$	$\log K_1 = 2.69$
$\equiv\text{FeOH}^\circ + \text{Be}^{2+} \rightleftharpoons \equiv\text{FeOHBe}^{2+}$	$\log K_2 = 10.61$
$\equiv\text{FeOH}^\circ + \text{Tl}^+ \rightleftharpoons \equiv\text{FeOTl}^\circ + \text{H}^+$	$\log K_1 = -5.37$
$\equiv\text{FeOH}^\circ + \text{Tl}^+ \rightleftharpoons \equiv\text{FeOHTl}^+$	$\log K_2 = 3.66$
$\equiv\text{FeOH}^\circ + \text{Cr(OH)}_2^+ \rightleftharpoons \equiv\text{FeOCrOH}^+ + \text{H}_2\text{O}$	$\log K_1 = 8.07$

Table B.5 Goethite Sorption Reactions Used In MINTEQA2 (continued)

Goethite Sorption Reaction	Intrinsic Equilibrium Constant
$\equiv\text{FeOH}^\circ + \text{Cr(OH)}_2^+ + \text{H}^+ \rightleftharpoons \equiv\text{FeOHCrOH}^{+2} + \text{H}_2\text{O}$	$\log K_2 = 16.07$
$\equiv\text{FeOH}^\circ + \text{H}_3\text{AsO}_3^\circ \rightleftharpoons \equiv\text{FeH}_2\text{AsO}_3^\circ + \text{H}_2\text{O}$	$\log K_1 = 4.33$
$\equiv\text{FeOH}^\circ + \text{H}_3\text{AsO}_4^\circ \rightleftharpoons \equiv\text{FeH}_2\text{AsO}_4^\circ + \text{H}_2\text{O}$	$\log K_1 = 6.87$
$\equiv\text{FeOH}^\circ + \text{H}_3\text{AsO}_4^\circ \rightleftharpoons \equiv\text{FeHAsO}_4^- + \text{H}^+ + \text{H}_2\text{O}$	$\log K_2 = -0.89$
$\equiv\text{FeOH}^\circ + \text{H}_3\text{AsO}_4^\circ \rightleftharpoons \equiv\text{FeOHAsO}_4^{3-} + 3\text{H}^+$	$\log K_4 = -11.09$
$\equiv\text{FeOH}^\circ + \text{VO}_2^+ + \text{H}_2\text{O} \rightleftharpoons \equiv\text{FeH}_2\text{VO}_4^\circ + \text{H}^+$	$\log K_1 = 2.35$
$\equiv\text{FeOH}^\circ + \text{VO}_2^+ + \text{H}_2\text{O} \rightleftharpoons \equiv\text{FeHVO}_4^- + 2\text{H}^+$	$\log K_2 = -5.91$
$\equiv\text{FeOH}^\circ + \text{VO}_2^+ + 2\text{H}_2\text{O} \rightleftharpoons \equiv\text{FeOHVO}_4^{3-} + 4\text{H}^+$	$\log K_4 = -17.53$
$\equiv\text{FeOH}^\circ + \text{Sb(OH)}_6^- + \text{H}^+ \rightleftharpoons \equiv\text{FeOH}_2\text{Sb(OH)}_6^\circ$	$\log K_1 = 11.94$
$\equiv\text{FeOH}^\circ + \text{Sb(OH)}_6^- \rightleftharpoons \equiv\text{FeOHSb(OH)}_6^-$	$\log K_2 = 5.76$
$\equiv\text{FeOH}^\circ + \text{SO}_4^{2-} + 2\text{H}^+ \rightleftharpoons \equiv\text{FeHSO}_4^\circ + \text{H}_2\text{O}$	$\log K_1 = 12.89$
$\equiv\text{FeOH}^\circ + \text{SO}_4^{2-} + \text{H}^+ \rightleftharpoons \equiv\text{FeSO}_4^- + \text{H}_2\text{O}$	$\log K_2 = 6.74$
$\equiv\text{FeOH}^\circ + \text{SO}_4^{2-} \rightleftharpoons \equiv\text{FeOSO}_4^{3-} + \text{H}^+$	$\log K_4 = -6.26$
$\equiv\text{FeOH}^\circ + \text{HSeO}_3^- + \text{H}^+ \rightleftharpoons \equiv\text{FeHSeO}_3^\circ + \text{H}_2\text{O}$	$\log K_1 = 3.25$
$\equiv\text{FeOH}^\circ + \text{HSeO}_3^- \rightleftharpoons \equiv\text{FeSeO}_3^- + \text{H}_2\text{O}$	$\log K_2 = 2.09$
$\equiv\text{FeOH}^\circ + \text{HSeO}_3^- \rightleftharpoons \equiv\text{FeOSeO}_3^{3-} + 2\text{H}^+$	$\log K_4 = -14.25$
$\equiv\text{FeOH}^\circ + \text{SeO}_4^{2-} + 2\text{H}^+ \rightleftharpoons \equiv\text{FeHSeO}_4^\circ + \text{H}_2\text{O}$	$\log K_1 = 11.65$
$\equiv\text{FeOH}^\circ + \text{SeO}_4^{2-} + \text{H}^+ \rightleftharpoons \equiv\text{FeSeO}_4^- + \text{H}_2\text{O}$	$\log K_2 = 6.54$
$\equiv\text{FeOH}^\circ + \text{CrO}_4^{2-} + 2\text{H}^+ \rightleftharpoons \equiv\text{FeHCrO}_4^\circ + \text{H}_2\text{O}$	$\log K_1 = 17.11$
$\equiv\text{FeOH}^\circ + \text{CrO}_4^{2-} + \text{H}^+ \rightleftharpoons \equiv\text{FeCrO}_4^- + \text{H}_2\text{O}$	$\log K_2 = 11.17$
$\equiv\text{FeOH}^\circ + \text{CrO}_4^{2-} \rightleftharpoons \equiv\text{FeOHCrO}_4^{2-}$	$\log K_3 = 4.05$
$\equiv\text{FeOH}^\circ + \text{MoO}_4^{2-} + 2\text{H}^+ \rightleftharpoons \equiv\text{FeHMoO}_4^\circ + \text{H}_2\text{O}$	$\log K_1 = 14.65$
$\equiv\text{FeOH}^\circ + \text{MoO}_4^{2-} + \text{H}^+ \rightleftharpoons \equiv\text{FeMoO}_4^- + \text{H}_2\text{O}$	$\log K_2 = 8.18$
$\equiv\text{FeOH}^\circ + \text{F}^- + \text{H}^+ \rightleftharpoons \equiv\text{FeOH}_2\text{F}^\circ$	$\log K_1 = 9.20$
$\equiv\text{FeOH}^\circ + \text{F}^- \rightleftharpoons \equiv\text{FeOHF}^-$	$\log K_2 = 1.59$

2.3.2 Particulate Organic Matter Sorbent

We obtained the concentration of the second adsorbent, particulate organic matter, from organic matter distributions already present in EPACMTP. EPACMTP includes frequency distributions for organic matter for three soil types in the unsaturated zone: silty clay loam, sandy loam, and silty loam. The silty loam soil type is intermediate in weight percent organic matter in comparison with the other two and is the most frequently occurring soil type. Therefore, low, medium, and high POM content levels for the MINTEQA2 modeling in the unsaturated zone were established as the 7.5, 50, and 92.5 percentiles of the silty loam organic matter distribution. In the saturated zone, the EPACMTP distribution of organic matter is identical to that for the sandy loam

soil type of the unsaturated zone. Low, medium, and high POM content levels in MINTEQA2 modeling of the saturated zone were established as the 7.5, 50, and 92.5 percentile levels, respectively, of this distribution.

As was the case for the goethite sorbent, the concentration of POM included in the MINTEQA2 modeling was determined from the low, medium, and high content levels (expressed in weight percent POM) and the mass of soil appropriate for one liter of pore water solution (see section 2.3.1). Thus, phase ratios of 4.57 kg/L in the unsaturated zone and 3.56 kg/L in the saturated zone were used to compute the POM concentration for MINTEQA2 model runs.

We obtained a dissolved organic carbon (DOC) distribution for the saturated zone from the U.S. EPA STORET database. This distribution is based on 1343 ground-water samples and is approximated by a log normal distribution with a median \log_e DOC of 1.974 (corresponding to 7.2 mg C per liter) and \log_e standard deviation of 1.092. Assuming DOM is approximately 50 percent organic carbon, the DOC values are multiplied by two to approximate DOM concentrations. The MINTEQA2 modeling employed low, medium and high concentrations for DOM corresponding to the 7.5, 50.0, and 92.5 percentiles, respectively, of this approximated DOM distribution. An important point to note is that POM and DOM were not treated as independent variables in the MINTEQA2 modeling: the high DOM value was associated with the high POM value, the medium DOM with the medium POM, etc.

Because no directly measured data were available for describing the variation in DOM concentration in the unsaturated zone, we assumed that high, medium, and low DOM concentrations reflected a constant ratio of POM content (in weight percent) to DOM concentration. The constant ratio was arbitrarily chosen as the ratio of the median DOM (mg/L) from the saturated zone distribution to the median value of POM (weight percent) from the saturated zone distribution. This ratio, 194.6, was applied to the low, medium, and high weight percent POM values of the unsaturated zone to obtain DOM concentrations at the low, medium, and high levels. The weight percent POM and concentration (mg/L) of both POM and DOM is shown in Table B.6 for all three concentration levels in both zones.

For both POM and DOM, we assumed a site density of 1.2×10^{-6} moles of sites per mg organic matter. The site concentrations for organic matter in both zones are listed in Table B.7.

Table B.6 POM And DOM Concentration Levels

	POM wt%	POM Concentration (mg/L)	DOM Concentration (mg/L)
<i>Unsaturated zone</i>			
Low	0.034	1553.8	6.6
Medium	0.105	4798.5	20.4
High	0.325	14852.5	63.20
<i>Saturated zone</i>			
Low	0.020	712.0	3.00
Medium	0.074	2634.4	14.40
High	0.275	9790.0	69.38

Table B.7 Site Concentrations For POM And DOM Components In MINTEQA2

	POM Site Concentration (mol/L)	DOM Site Concentration (mol/L)
<i>Unsaturated zone</i>		
Low	1.865×10^{-3}	7.896×10^{-6}
Medium	5.758×10^{-3}	2.439×10^{-5}
High	1.782×10^{-2}	7.548×10^{-5}
<i>Saturated zone</i>		
Low	8.544×10^{-4}	3.600×10^{-6}
Medium	3.161×10^{-3}	1.728×10^{-5}
High	1.175×10^{-2}	8.326×10^{-5}

We used a specialized sub-model within MINTEQA2 for calculations involving the POM and DOM. This sub-model, called the Gaussian distribution model, assumes that natural organic matter is a mixture of various functional groups having a mean log K for binding protons and metals, and a standard deviation in log K (Dobbs et al., 1989). This is in contrast to all other reactants in MINTEQA2 which are implicitly treated as pure substances with a single equilibrium constant for a particular metal. A database of DOM reactions proposed by Susetyo et al. (1991) for the metals Ba, Cd, Cr(III), Cu, Pb, Ni, and Zn and for protons and various other MINTEQA2 components is included with version 4.02 of the model. Adsorption of metals onto POM was included in the model calculations by assuming that the reactions were identical to those for metal complexation with DOM. Table B.8 shows Gaussian organic matter reactions used in MINTEQA2 for this work. Although the Gaussian model was

proposed for metal-DOM reactions, we used it here to account for metal-POM reactions as well. The only difference between the method of calculation for metal-DOM and metal-POM species in MINTEQA2 was that POM species were excluded from contributing to the ionic strength.

For the metals Ag, Co, Hg, and Tl, it was necessary to estimate the mean log K for DOM and POM binding for use in MINTEQA2. The mean log K values for Ag, Co, and Tl were derived from a linear free-energy relationship based upon known mean log K values for several metals, their first hydrolysis constants, and their log K values for complexation with acetate. For Hg, the mean log K was estimated from a linear regression based on binding constants for humic and fulvic acid as given by Tipping (1994).

Table B.8 POM And DOM Reactions Included In MINTEQA2 Modeling

Organic Matter (OM) Reaction	Mean log K	Standard Deviation	Species Charge
OM + H ⁺ ⇌ OM-H	3.87	1.7	-1.8
OM + Ca ²⁺ ⇌ OM-Ca	2.9	1.7	-0.8
OM + Mg ²⁺ ⇌ OM-Mg	1.9	1.7	-0.8
OM + Ba ²⁺ ⇌ OM-Ba	3.1	1.7	-0.8
OM + Be ²⁺ ⇌ OM-Be	3.5	1.7	-0.8
OM + Cd ²⁺ ⇌ OM-Cd	3.3	1.7	-0.8
OM + Cr(OH) ₂ ⁺ + 2H ⁺ ⇌ OM-Cr + 2H ₂ O	15.22	1.7	0.2
OM + Cu ²⁺ ⇌ OM-Cu	4.9	1.7	-0.8
OM + Ni ²⁺ ⇌ OM-Ni	3.3	1.7	-0.8
OM + Pb ²⁺ ⇌ OM-Pb	5.2	1.7	-0.8
OM + Zn ²⁺ ⇌ OM-Zn	3.5	1.7	-0.8
OM + Hg(OH) ₂ ⁰ + 2H ⁺ ⇌ OM-Hg + 2H ₂ O	15.2	1.7	-0.8
OM + Co ²⁺ ⇌ OM-Co	3.3	1.7	-0.8
OM + Ag ⁺ ⇌ OM-Ag	2.0	1.7	-1.8
OM + Tl ⁺ ⇌ OM-Tl	1.0	1.7	-1.8
OM + Mn ²⁺ ⇌ OM-Mn	3.0	1.7	-0.8

2.4 LEACHATE ORGANIC MATTER

In addition to the metal contaminants, the leachate exiting a landfill may contain elevated concentrations of leachate organic matter. This organic matter may consist of various compounds including organic acids that represent primary disposed waste or that result from the breakdown of more complex organic substances. Many organic acids found in landfill leachate have significant metal-complexing capacity that may influence metal mobility. In an effort to incorporate in the K_d modeling the solubilizing effect of organic acids, we included three representative monoprotic acids as

components. Data presented by Gintautas et al. (1993) were used to select and quantify the three representative organic acids. Gintautas examined leachates from six landfills from across the U.S. Their analyses indicated the presence of over 30 different acids—most were carboxylic. The three acids chosen to represent the complex mixture of leachate acids in the MINTEQA2 modeling were acetic acid, propionic acid, and butyric acid. These were selected based on structure-activity relationships, comparison of equilibrium constants, and relative concentrations in the leachates analyzed by Gintautas.

In the MINTEQA2 modeling, low, medium, and high concentration levels for the representative acids were established based on the lowest, the average, and the highest measured TOC among the six landfill leachates. The same set of three acids was used in both the unsaturated and saturated zones. In the latter, their concentrations were one-seventh of their unsaturated zone concentrations. This reduction in the leachate acid concentration was applied to account in a rudimentary way for the effects of dispersion and diffusion in the mixing zone. The factor of one-seventh resulted from flow model tests to estimate an “average” dilution factor in the mixing zone. Table B.9 gives the low, medium, and high concentrations used in the MINTEQA2 modeling for each of the three acids in each zone.

The MINTEQA2 thermodynamic database includes complexation reactions between each of the three representative acids and many of the contaminant metals of interest. Acid-base and major ion reactions are also included. Some metals, especially those that behave as anions in aqueous solution (e.g., arsenite, arsenate, chromate, etc.) do not complex with these acids.

Table B.9 Model Concentrations Of Representative Leachate Acids

Concentration Level	Acetic acid (mg/L)	Propionic acid (mg/L)	Butyric acid (mg/L)
<i>Unsaturated zone</i>			
Low	24.80	14.61	15.68
Medium	111.00	64.30	67.94
High	274.60	158.60	169.00
<i>Saturated zone</i>			
Low	3.54	2.09	2.24
Medium	15.86	9.19	9.71
High	39.23	22.66	24.14

2.5 MINTEQA2 MODELING PROCEDURE

The MINTEQA2 modeling was conducted separately for each of the twenty-two contaminant metals. For each metal, the modeling was performed separately for each zone (unsaturated and saturated) for each of the two ground waters. Thus, results were produced in four main categories: the carbonate ground-water unsaturated zone, the carbonate ground-water saturated zone; the non-carbonate ground-water unsaturated zone, and the non-carbonate ground-water saturated zone. Within each of these four categories, we followed a similar modeling procedure. The modeling procedure consisted of three steps, each involving execution of the MINTEQA2 model. First, the sorbents were pre-equilibrated with the ground water at the natural ground-water pH. Second, the pre-equilibrated ground-water sorbent systems were titrated to different pH's of interest. Finally, leachate organic acids and the contaminant metal were added to the pre-equilibrated, pH-adjusted systems. In this last step, the metal salt was added to each system at a series of forty-four total concentrations as in a titration and the model computed the equilibrium distribution at each titration point to produce an isotherm.

2.5.1 Pre-equilibration With Sorbents

The goethite and POM sorbents were pre-equilibrated with the ground water at all nine combinations of their concentration levels. Because the sorbents adsorb some of the non-contaminant ions present as ground-water constituents (calcium, magnesium, sulfate, fluoride), we assume the representative compositions used for both the carbonate and non-carbonate ground waters reflect dissolved concentrations at equilibrium with an unknown sorbed concentration. The purpose of the pre-equilibration step is to estimate this unknown sorbed concentration so that it may be included in subsequent model runs. The method of discovering the sorbed totals for each of the ground-water constituents that undergoes sorption was trial and error. Specifically, MINTEQA2 was executed repeatedly with adjusted total concentrations of these sorbing constituents until the equilibrium dissolved concentration for each was equal to the measured dissolved concentrations reported for the ground water. This trial and error pre-equilibration method was performed separately for each of nine possible combinations of the FeOx and POM sorbent concentrations (e.g., low FeOx, low POM; low FeOx, medium POM; from Table B.4).

The pre-equilibration step was conducted at the natural pH of each ground water, and calcite was imposed as an equilibrium mineral for the carbonate ground-water type. Small additions of inert ions (Na^+ or NO_3^-) were added to maintain charge balance.

2.5.2 Titrating Systems To New pH Values

The nine pre-equilibrated systems were titrated to target pH's that span the pH range commonly observed for that ground-water type. Rather than imposing target pH's as equilibrium constraints in the model, we used acids and bases to titrate to the pH targets. The titrants for pH adjustment were NaOH to raise the pH and HNO_3 to lower the pH. For the carbonate ground water, the pH was assumed to range from 7.0

to 8.0. Since the natural pH of the carbonate ground water was 7.5, the acid and base were used to lower and raise the pH to 7.0 and 8.0, respectively, resulting in three pH values for this ground water. Since this was done for each of the nine pre-equilibrated systems, the outcome of this titration step was twenty-seven variants of the carbonate ground-water system exhibiting various concentration levels of the sorbent and various pH values. Equilibrium with calcite was maintained in all of these carbonate systems.

For the non-carbonate ground water, the pH of interest was assumed to span the range 4.5 to 8.2. Each of the nine pre-equilibrated non-carbonate systems was titrated to nine target pH's within this range: 4.5, 5.1, 5.6, 6.0, 6.3, 6.6, 6.9, 7.4, and 8.2. Since the natural pH of the non-carbonate ground water was 7.4, the base was used only to titrate to pH 8.2. The lower pH's were attained by titrating with the acid. The outcome of the titration step for the non-carbonate ground water was eighty-one variants of the non-carbonate ground-water system exhibiting various concentration levels of the sorbent and various pH values.

2.5.3 Addition Of Leachate Acids And Contaminant Metal

Each of the pre-equilibrated, pH-adjusted systems were equilibrated with the three concentration levels of leachate organic acids (see Table B.9). As before, the equilibrium pH was not imposed as a constraint in MINTEQA2, so the addition of the leachate acid impacted the calculated equilibrium pH. Because there were three concentration levels for the leachate organic acids, this step resulted in 81 leachate-ground-water systems for each zone (unsaturated and saturated) for the carbonate ground water and 243 leachate-ground-water systems for each zone for the non-carbonate ground water .

The contaminant metal was added in the same step as the leachate organic acids. The metal was added as a metal salt at a series of forty-four total concentrations spanning the range 0.001 mg/L to 10,000 mg/L of metal. The choice of chemical species by which the metal was introduced was predicated on the desire to maintain charge balance and to avoid species that would exert a great influence on the equilibrium pH. In some cases, we introduced a fictitious substance to accomplish these goals. The equilibrium distribution was calculated at each of the forty-four total metal concentrations to produce an isotherm of sorbed metal versus metal concentration.

3.0 **RESULTS**

As shown in Figure B.1, MINTEQA2 computes the equilibrium distribution of metal among three categories: dissolved, sorbed, and precipitated. The concentration in the first two of these categories along with the corresponding total metal concentration define the non-linear isotherm. All three concentrations (dissolved, sorbed, and precipitated) are made available for use in EPACMTP, but the precipitated concentration is not used. The ratio of the equilibrium sorbed and dissolved concentrations recorded in the isotherm is the dimensionless K_d . For the sorbed fraction, the concentration recorded in the isotherm is the amount of metal sorbed *from* one liter of solution. Of course, this amount is also sorbed *onto* the mass of soil with which one liter was equilibrated. This mass is the phase ratio: 4.57 kg/L for the unsaturated zone and 3.56 kg/L for the saturated zone. The K_d in units of L/kg is thus computed by normalizing the dimensionless K_d by the appropriate phase ratio.

For each metal, the modeling resulted in 243 isotherms for the non-carbonate ground water for the unsaturated zone, and 81 isotherms for the carbonate ground water for the unsaturated zone. We produced a like number of isotherms for each ground water for the saturated zone. Each isotherm corresponds to particular concentration levels of FeOx and POM sorbents, pH, and leachate organic matter concentration. In monte carlo or site-specific mode, EPACMTP selects the appropriate isotherm based on the conditions being modeled. Isotherms were produced for Ag, As(III), As(V), Ba, Be, Cd, Co, Cr(III), Cr(VI), Cu, F, Hg, Mn(II), Mo(V), Ni, Pb, Sb(V), Se(IV), Se(VI), Tl(I), V(V), and Zn.

3.1 **EXAMPLE ISOTHERMS**

Example isotherms for Cr(VI) are shown in Figure B.2. This figure shows K_d versus total Cr(VI) concentration for the non-carbonate ground water saturated zone at various pH values. The isotherms plotted are for the medium concentration level of FeOx and POM sorbents and the low concentration level of leachate organic matter. Because chromate behaves as an anion in ground water, its adsorption is enhanced at low pH relative to high pH. This behavior is reversed for metals that behave as cations.

Figure B.3 shows the impact of FeOx concentration level on the K_d values of lead. As expected, sorption is enhanced at the higher FeOx concentrations resulting in larger K_d values. The example shown is for the unsaturated zone of the carbonate ground water with the low concentration levels of POM and leachate organic acids. The pH corresponds to the lowest setting for the carbonate systems: 7.0.

The impact of varying the POM concentration level differs among the various metals. The effect of POM concentration level also depends on the pH. The variable impact of POM is due to two factors: the absence of organic matter reactions for anionic metals and the concurrent influence of DOM for those metals for which organic matter reactions are included. In the MINTEQA2 modeling procedure we used, increasing the POM sorbent concentration is always accompanied by a proportional increase in the DOM concentration. The overall impact on the amount of metal sorbed depends on the

relative competition among all constituents in the systems for these two substances. The “winner” of this relative competition (POM or DOM) shifts with pH because both substances undergo acid-base reactions. Figure B.4 shows the impact of varying the POM/DOM concentration level on lead sorption for the non-carbonate ground water unsaturated zone with medium FeOx concentration level and low leachate organic matter concentration level at pH 6.3.

The influence of the leachate organic matter concentration level is illustrated in Figure B.5 for copper sorption. The LOM level is represented in the model by particular concentrations of three representative leachate organic acids. The acids exert two modes of influence on metal sorption: (1) they lower the pH, reducing sorption of cations and enhancing sorption of anions; (2) for those metals that complex these acids, metal sorption is reduced through competition. The latter effect is generally restricted to metals that behave as cations. The results shown in Figure B.5 correspond to high concentration levels of FeOx and POM sorbents in the unsaturated zone for the carbonate ground water. The pH is 7.0.

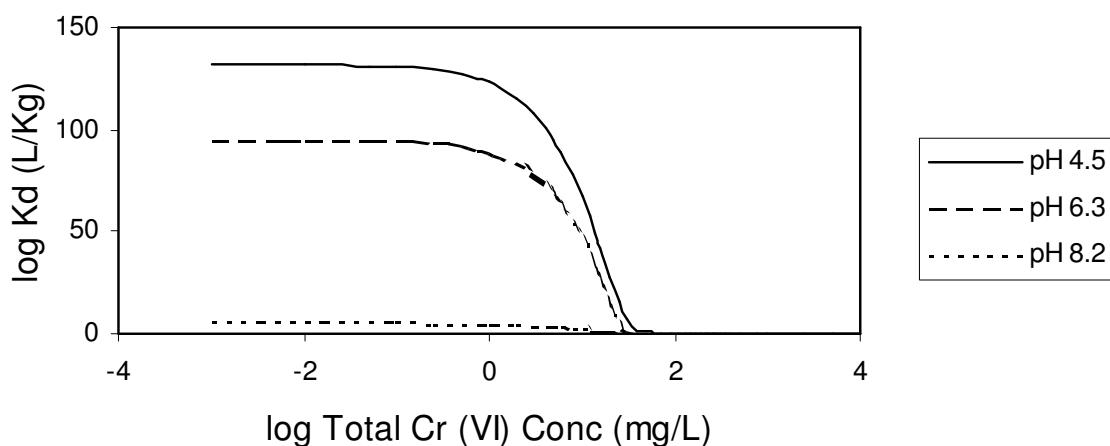


Figure B.2 Cr(VI) Isotherms Illustrating Influence of pH.

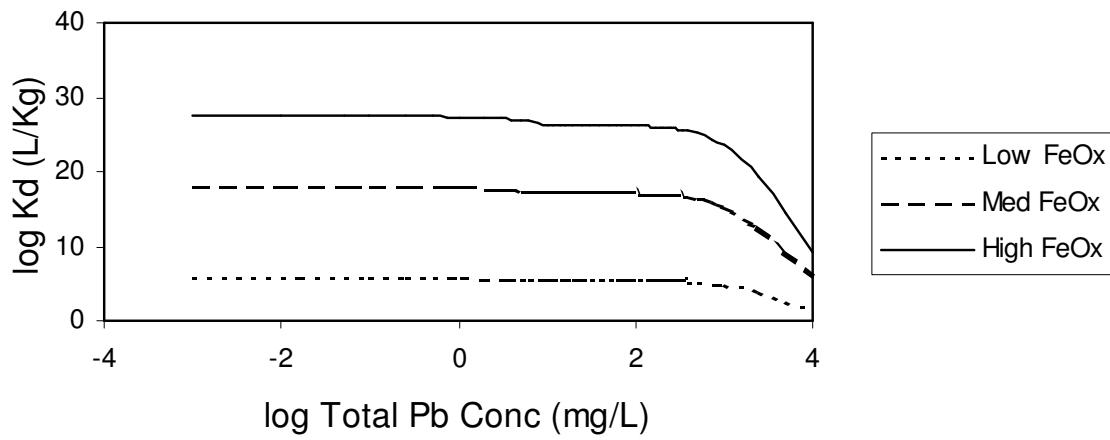


Figure B.3 Pb Isotherms Illustrating Influence of FeOx Sorbent Concentration.

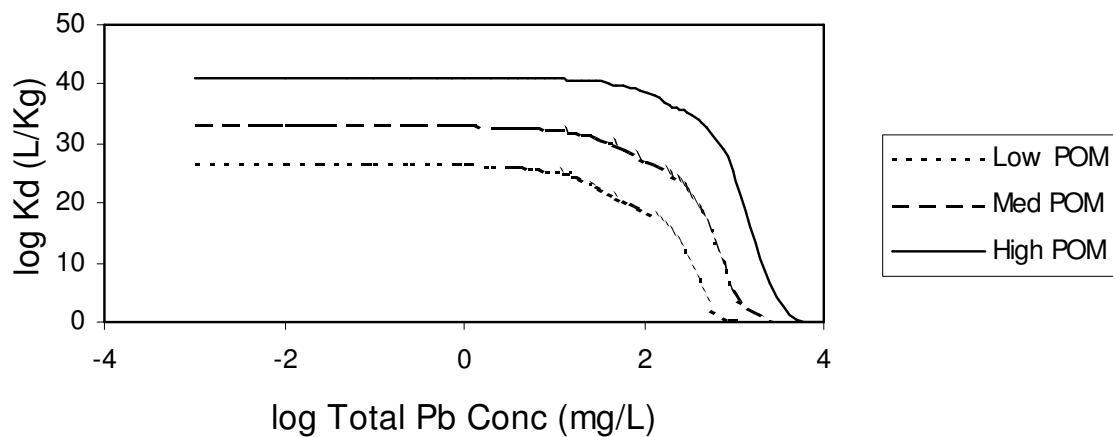


Figure B.4 Pb Isotherms Illustrating Influence of POM/DOM Concentration.

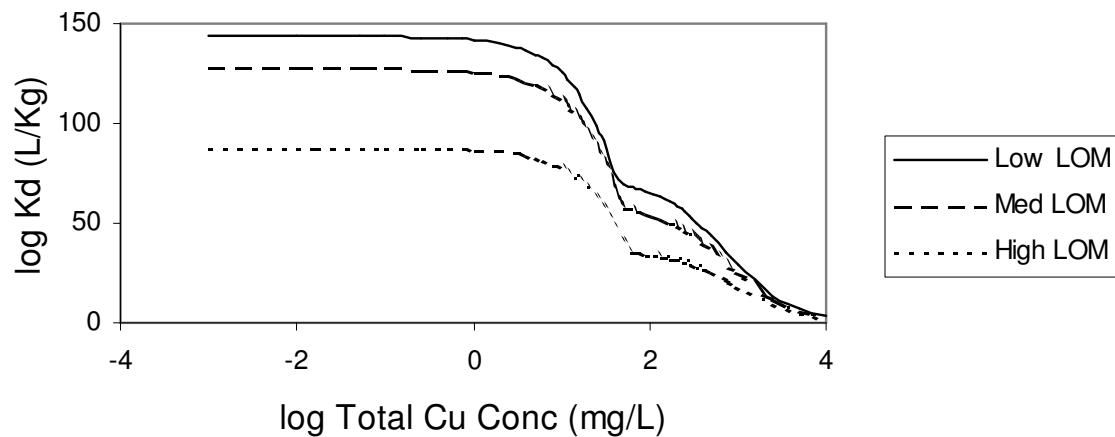


Figure B.5 Cu Isotherms Illustrating Influence of LOM Concentration.

4.0 ASSUMPTIONS AND LIMITATIONS

There are many assumptions inherent in the use of a speciation model to estimate partition coefficients. Some of these must be acknowledged to result in limitations on the utility of the model results. Undoubtedly, the results are better for some metals than for others. Various modeling assumptions and limitations we used are presented below. These are organized as those resulting from the manner in which the ground-water composition, the sorbents, and the leachate were characterized, and certain broader, more general issues. The discussion is limited to pointing out each assumption or limitation. Although the direction of possible error in the estimated K_d values is apparent from some of these limitations, it would seem to be impossible to quantify the uncertainty in the estimated K_d values.

4.1 GROUND-WATER CHARACTERIZATION ISSUES

- The categorization of all ground waters into two types, carbonate and non-carbonate, is quite broad. The non-carbonate category is especially broad, and sorption behavior among different ground-water compositions that might fall into this category could be quite variable. We did not account for this variability in the current approach.
- Although the pre-equilibration step is helpful in more realistically establishing appropriate major ion concentrations, it is somewhat artificial in the sense that sorbents are not correlated with ground water. Both the FeOx and POM sorbents were represented as general concentration distributions; the concentration levels used do not correlate specifically to the ground-water compositions used.
- Both ground waters were artificially adjusted to different pH's of interest by titrating with an acid or base. The degree to which this procedure can result in model ground-water compositions that adequately represent true variability in factors that impact K_d is unknown.

4.2 SORBENT CHARACTERIZATION ISSUES

- Only two sorbents are represented in the model systems. Other sorbents are important in some circumstances including clays, hydrous aluminum and manganese oxides, calcite, and silica. Failure to include all potential sorbents could result in underestimation of sorption.
- The ferric oxide was accounted in the modeling as goethite. Other ferric oxides may be important in ground water, including hydrous ferric oxide (HFO). HFO has a higher specific surface area and greater reactivity for some metals than does goethite. The degree of sorption may be underestimated for some metals in systems where HFO is the dominant form of ferric oxide. Also, equilibrium constants for adsorption onto goethite were unavailable for some metals; estimates were used.

- The data used to quantify the FeOx and POM sorbents (and the DOM) is sparse. The degree to which the true variability in concentration levels of these sorbents has been captured in the modeling is unknown.
- There is no provision in the modeling to account for occlusion of sorbents. Both ferric oxide and organic matter may form coatings over other surfaces. Failure to account for occlusion could result in overestimating the available sorption sites.
- The ferric oxide (goethite) sorbent is included in all model runs. This implies that it is ubiquitous. However, there are natural ground-water conditions that preclude the formation of ferric oxide precipitates. As illustrated in Figure B.6, goethite is not the stable iron solid phase at conditions of low pH and low E_h . The approximate pH- E_h window of applicability for the model results is outlined by dashes in this figure. The selection of specific pH targets limits the pH range (4.5 to 8.2). But no explicit E_h was defined in the model (wavy lines at top and bottom of window in Figure B.6). The “implied” E_h minimum could be considered as the level where ferric oxide ceases to be the stable iron phase. Within the pH range of interest, this implies that the lower left corner of the window shown in Figure B.6 is inconsistent with the use of goethite as a sorbing phase. Including the goethite sorbent where it cannot exist could obviously lead to overestimating sorption. The omission of the stable iron phases siderite and pyrite as model sorbents serves to compensate for this flaw, although the extent of this compensation is unknown. The main point of the diagram is not to point out the stability fields of specific iron minerals but to show the applicability window for our modeling (framed by pH and Eh) with reference to the general picture of iron sulfide, carbonate, and hydroxide (or oxide) minerals.
- The Gaussian model for estimating metal interactions with organic matter was developed for dissolved organic matter. It has not been tested for estimating the degree of metal sorption onto POM. Also, mean log K values for some metals have not been measured; estimates were used.

4.3 LEACHATE CHARACTERIZATION ISSUES

- The concentration levels for leachate organic matter were based on a limited sampling from six municipal landfills. Municipal landfills may have leachate organic content that is significantly different from that of hazardous waste units. Hazardous waste leachates may show more variability in total organic carbon concentration and in the nature of the organic species present.
 - Other leachate constituents may be present at elevated concentrations, but these are not accounted for. Some of these (e.g., Ca, Mg, SO_4 , Cl, etc.) may reduce the amount of metal sorption by competing for adsorption sites (especially Ca) or by complexing metals so that a greater fraction is retained in solution (especially SO_4 and Cl). Failure to include these effects could result in overestimating sorption of some metals.
-

- Leachate from highly alkaline wastes was not included in the modeling. Highly alkaline leachates may result in elevation of the ground-water pH above the upper bound for which isotherms have been computed. Sorption tends to increase with pH for many metals up to about pH 8 to 9. Above this level, formation of metal hydroxy solution species may inhibit sorption for some metals.
- The metal was introduced as a metal salt. The metal species was chosen to avoid impact on the pH, but some pH effect is unavoidable. Arbitrary changes in pH due to the choice of metal species may have induced undesired changes in K_d , especially at high total metal concentrations.
- Methylated forms of metal were not accounted for in this modeling. Mercury and arsenic are known to undergo methylation in the environment.

4.4 OTHER ISSUES

- The system redox potential was not explicitly defined in the modeling. All species that might undergo oxidation-reduction reactions were constrained to remain in the form in which they were entered in the model. This restriction applied to major ions such as sulfate and to all trace metals. The impact on K_d is unknown, but is expected to be metal-specific.
- All contaminant metals were introduced separately and individually in the modeling. The possible simultaneous presence of multiple metals is unaccounted for. The impact on K_d is not expected to be great except at high metal concentrations where competition for sorption sites may result in less sorption for some metals than suggested by this modeling.

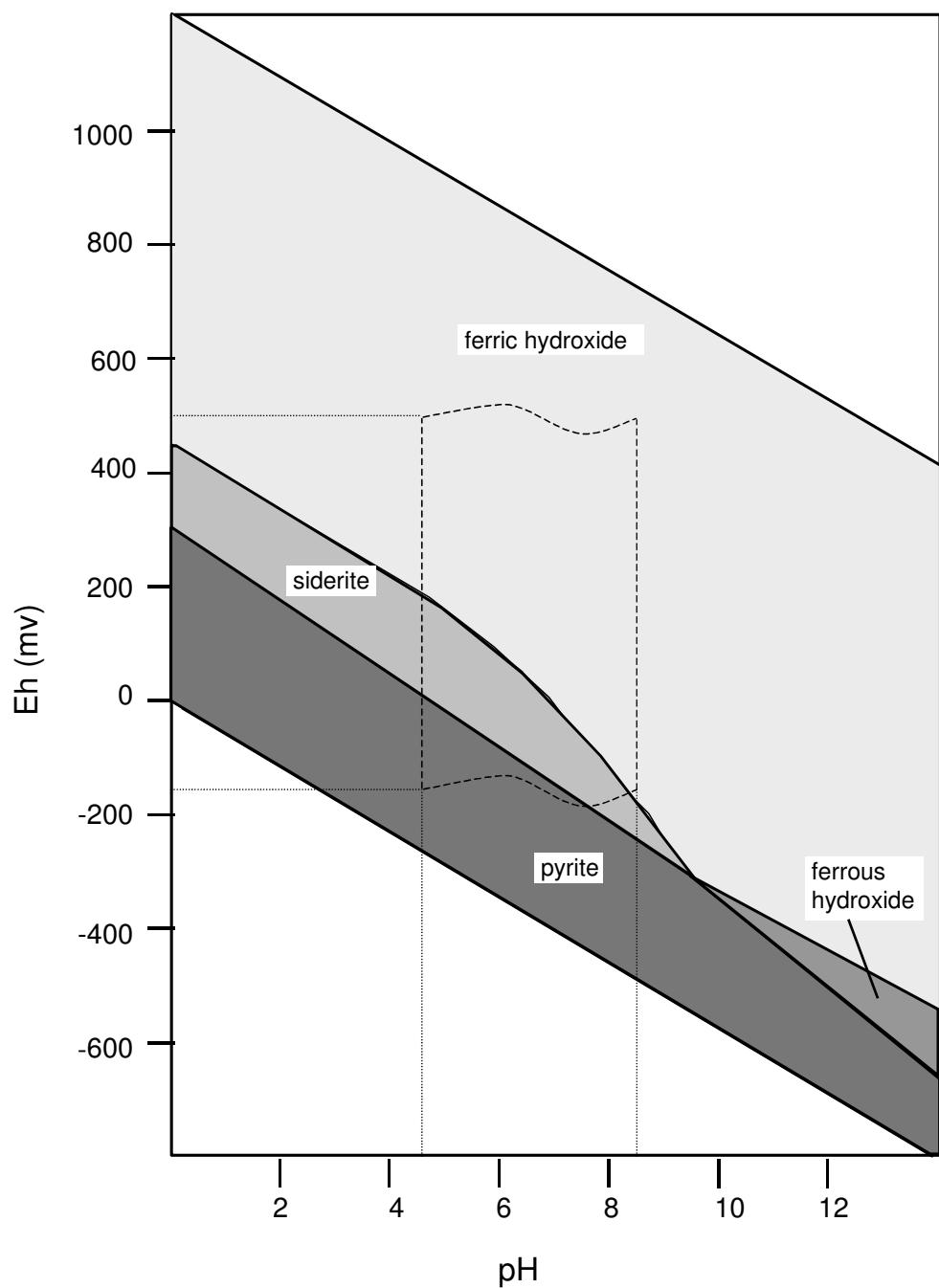


Figure B.6 Relevant pH- E_h Window And Stable Iron Phases (after Hem, 1977).

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APPENDIX C

PHYSICAL AND CHEMICAL PROPERTIES FOR ORGANIC CONSTITUENTS

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CAS	Constituent Name	Molecular Weight (g/mol) (a)	Solubility (mg/L) (b)	Log Koc (log[mL/g]) (c)	Hydrolysis Rate Constants (c)			Diffusion Coefficient in Water (Di) (m ² /yr) (d)
					Acid Catalyzed (Ka) (1/mol/yr)	Neutral (Kn) (1/yr)	Base Catalyzed (Kb) (1/mol/yr)	
83-32-9	Acenaphthene	154.2	4.24	3.75	0	0	0	
75-07-0	Acetaldehyde [Ethanal]	44.1	1.0E+06 (e)	-0.21 (h)	0	0	0	0.0426
67-64-1	Acetone (2-propanone)	58.1	1.0E+06 (e)	-0.59	0	0	0	0.0363
75-05-8	Acetonitrile (methyl cyanide)	41.1	1.0E+06 (e)	-0.71	0	0	45	0.0445
98-86-2	Acetophenone	120.2	6.13E+03	1.26	0	0	0	
107-02-8	Acrolein	56.1	2.13E+05	-0.22		6.7E+08		0.0385
79-06-1	Acrylamide	71.1	6.4E+05	-0.99	31.5	0.018	0	0.0397
79-10-7	Acrylic acid [propenoic acid]	72.1	1.0E+06 (e)	-1.84	0	0	0	0.0378
107-13-1	Acrylonitrile	53.1	7.4E+04	-0.09	500	0	5.2E+03	0.0388
309-00-2	Aldrin	364.9	0.18	6.18	0	0	0	0.0184
107-18-6	Allyl alcohol	58.1	1.0E+06 (e)	1.47 (e)	0	0	0	
62-53-3	Aniline (benzeneamine)	93.1	3.6E+04	0.60	0	0	0	0.0319
120-12-7	Anthracene	178.2	4.3E-02	4.21	0	0	0	
7440-36-0	Antimony	121.8						
7440-38-2	Arsenic	74.9						
7440-39-3	Barium	137.3						
56-55-3	Benz{a}anthracene	228.3	9.4E-03	5.34	0	0	0	0.0186 (i)
71-43-2	Benzene	78.1	1.75E+03	1.80	0	0	0	0.0325
92-87-5	Benzidine	184.2	500.0	1.26	0	0	0	0.0239
50-32-8	Benzo{a}pyrene	252.3	1.62E-03	5.80	0	0	0	0.0208
205-99-2	Benzo{b}fluoranthene	252.3	1.5E-03	5.80	0	0	0	0.0174 (i)
100-51-6	Benzyl alcohol	108.1	4.0E+04	0.78	0	0	0	
100-44-7	Benzyl chloride	126.6	525.00	2.84	0	410	0	0.0278
7440-41-7	Beryllium	9.0						
111-44-4	Bis(2-chloroethyl)ether	143.0	1.72E+04	0.80	0	0.23	0	0.0275
39638-32-9	Bis(2-chloroisopropyl)ether	171.1	1.31E+03	2.39	0		0	0.0233
117-81-7	Bis(2-ethylhexyl)phthalate	390.6	0.34	7.13	0	0	1.4E+03	0.0132
75-27-4	Bromodichloromethane	163.8	6.74E+03	1.77			5.0E+04	0.0337

CAS	Constituent Name	Molecular Weight (g/mol) (a)	Solubility (mg/L) (b)	Log Koc (log[mL/g]) (c)	Hydrolysis Rate Constants (c)			Diffusion Coefficient in Water (D) (m ² /yr) (d)
					Acid Catalyzed (Ka) (1/mol/yr)	Neutral (Kn) (1/yr)	Base Catalyzed (Kb) (1/mol/yr)	
74-83-9	Bromomethane	94.9	1.52E+04	0.76	0	9.46	0	0.0426
106-99-0	Butadiene 1,3-	54.1	735.00	2.06 (e)				0.0325
71-36-3	Butanol n-	74.1	7.4E+04	0.50	0	0	0	
85-68-7	Butyl benzyl phthalate	312.4	2.69	4.23	0	0	1.2E+05	
88-85-7	Butyl-4,6-dinitrophenol,2-sec-(Dinoseb)	240.2	52.00	2.02	0	0	0	
7440-43-9	Cadmium	112.4						
75-15-0	Carbon disulfide	76.1	1.19E+03	1.84	0	0	31500	0.041
56-23-5	Carbon tetrachloride	153.8	793.00	2.41	0	0.017	0	0.0308
57-74-9	Chlordane	409.8	0.06	5.89	0	0	37.7	0.0172
126-99-8	Chloro-1,3-butadiene 2-(Chloroprene)	88.5	1.74E+03	1.74	0	0	0	0.0315
106-47-8	Chloroaniline p-	127.6	5.3E+03	1.61	0	0	0	
108-90-7	Chlorobenzene	112.6	472.00	2.58	0	0	0	0.0299
510-15-6	Chlorobenzilate	325.2	11.10	4.04	0	0	2.8E+06	0.0173
124-48-1	Chlorodibromomethane	208.3	2.6E+03	1.91			2.5E+04	0.0334
75-00-3	Chloroethane [Ethyl chloride]	64.5	5.68E+03	0.51	0	0	0	0.0366
67-66-3	Chloroform	119.4	7.92E+03	1.58	0	1.0E-04	2740	0.0344
74-87-3	Chloromethane	50.5	5.33E+03	0.91				0.0429
95-57-8	Chlorophenol 2-	128.6	2.2E+04	1.82	0	0	0	0.0299
107-05-1	Chloropropene 3- (Allyl Chloride)	76.5	3.37E+03	1.13	0	40	0	0.0341
16065-83-1	Chromium (III) (Chromic Ion)	52.0						
18540-29-9	Chromium (VI)	52.0						
218-01-9	Chrysene	228.3	1.6E-03	5.34	0	0	0	0.0213
7440-48-4	Cobalt	58.9						
7440-50-8	Copper	63.5						
108-39-4	Cresol m-	108.1	2.27E+04	1.76	0	0	0	0.0294
95-48-7	Cresol o-	108.1	2.6E+04	1.76	0	0	0	0.0311

CAS	Constituent Name	Molecular Weight (g/mol) (a)	Solubility (mg/L) (b)	Log Koc (log[mL/g]) (c)	Hydrolysis Rate Constants (c)			Diffusion Coefficient in Water (Di) (m ² /yr) (d)
					Acid Catalyzed (Ka) (1/mol/yr)	Neutral (Kn) (1/yr)	Base Catalyzed (Kb) (1/mol/yr)	
106-44-5	Cresol p-	108.1	2.15E+04	1.76	0	0	0	0.0291
1319-77-3	Cresols	324.4	2.34E+04	2.12	0	0	0	0.0299
98-82-8	Cumene	120.2	61.30	3.40	0	0	0	0.0248
108-93-0	Cyclohexanol	100.2	4.3E+04 (e)	1.11 (g)	0	0	0	0.0295
108-94-1	Cyclohexanone	98.1	5.0E+03	1.82	0	0	0	
72-54-8	DDD	320.0	0.09	5.89	0	0.025	2.2E+04	
72-55-9	DDE	318.0	0.12	6.64	0	0	0	
50-29-3	DDT p,p'	354.5	0.03	6.59	0	0.06	3.1E+05	0.014
2303-16-4	Diallate	270.2	40.00	4.17	0	0.1	8.0E+03	
53-70-3	Dibenz{a,h}anthracene	278.4	0.00	6.52	0	0	0	0.019
96-12-8	Dibromo-3-chloropropane 1,2-	236.3	1.23E+03	1.94	0	4.0E-03	1.2E+05	0.0281
95-50-1	Dichlorobenzene 1,2-	147.0	156.00	3.08	0	0	0	0.0281
106-46-7	Dichlorobenzene 1,4-	147.0	73.80	3.05	0	0	0	0.0274
91-94-1	Dichlorobenzidine 3,3'-	253.1	3.11	3.32	0	0	0	0.0173 (i)
75-71-8	Dichlorodifluoromethane (Freon 12)	120.9	280.00	2.16				0.0341
75-34-3	Dichloroethane 1,1-	99.0	5.06E+03	1.46	0	1.13E-02	0.378	0.0334
107-06-2	Dichloroethane 1,2-	99.0	8.52E+03	1.13	0	9.61E-03	54.7	0.0344
75-35-4	Dichloroethylene 1,1-	96.9	2.25E+03	1.79	0	0	0	0.0347
156-59-2	Dichloroethylene cis-1,2-	96.9	3.5E+03	1.70	0	0	0	
156-60-5	Dichloroethylene trans-1,2-	96.9	6.3E+03	1.60	0	0	0	
120-83-2	Dichlorophenol 2,4-	163.0	4.5E+03	2.49	0	0	0	
94-75-7	Dichlorophenoxyacetic acid 2,4-(2,4-D)	221.0	677.00	0.68	0	0	0	
78-87-5	Dichloropropane 1,2-	113.0	2.8E+03	1.67	0	0	0	0.0307
542-75-6	Dichloropropene 1,3-(mixture of isomers)	111.0	2.8E+03	1.43				0.0319
10061-01-5	Dichloropropene cis-1,3-	111.0	2.72E+03	1.80	0	40	0	0.0322
10061-02-6	Dichloropropene trans-1,3-	111.0	2.72E+03	1.80	0	40	0	0.0319

CAS	Constituent Name	Molecular Weight (g/mol) (a)	Solubility (mg/L) (b)	Log Koc (log[mL/g]) (c)	Hydrolysis Rate Constants (c)			Diffusion Coefficient in Water (Di) (m ² /yr) (d)
					Acid Catalyzed (Ka) (1/mol/yr)	Neutral (Kn) (1/yr)	Base Catalyzed (Kb) (1/mol/yr)	
60-57-1	Dieldrin	380.9	0.20	5.08	0	6.30E-02	0	0.019
84-66-2	Diethyl phthalate	222.2	1.08E+03	1.99	0	0	3.1E+05	
56-53-1	Diethylstilbestrol	268.4	0.10	4.09	0	0	0	
60-51-5	Dimethoate	229.2	2.5E+04	0.13	0	1.68	4.48E+06	
119-90-4	Dimethoxybenzidine 3,3'-	0.0	60.00	1.49	0	0	0	
68-12-2	Dimethyl formamide N,N-[DMF]	73.1	1.0E+06 (g)	-0.99 (h)	0	0	0	0.0353
57-97-6	Dimethylbenz{a}anthracene 7,12-	256.3	2.50E-02	6.64	0	0	0	0.0172 (i)
119-93-7	Dimethylbenzidine 3,3'-	212.3	1.3E+03	2.55	0	0	0	
105-67-9	Dimethylphenol 2,4-	122.2	7.87E+03	2.29	0	0	0	
84-74-2	Di-n-butyl phthalate	278.3	11.20	4.37	0	0	1.8E+06	
99-65-0	Dinitrobenzene 1,3-	168.1	861.00	1.31	0	0	0	
51-28-5	Dinitrophenol 2,4-	184.1	2.79E+03	-0.09	0	0	0	
121-14-2	Dinitrotoluene 2,4-	182.1	270.00	1.68	0	0	0	0.0249
606-20-2	Dinitrotoluene 2,6-	182.1	182.00	1.40	0	0	0	
117-84-0	Di-n-octyl phthalate	390.6	0.02	7.60	0	0	5.2E+05	
123-91-1	Dioxane 1,4-	88.1	1.0E+06 (e)	-0.81	0	0	0	0.0331
122-39-4	Diphenylamine	169.2	35.70	3.30	0	0	0	
122-66-7	Diphenylhydrazine 1,2-	184.2	68.00	2.82	0	0	0	0.0229
298-04-4	Disulfoton	274.4	16.30	2.94	0	2.3	5.4E+04	
115-29-7	Endosulfan (Endosulfan I and II,mixture)	406.9	0.51	3.55				
72-20-8	Endrin	380.9	0.25	4.60	0	0.055	0	
106-89-8	Epichlorohydrin	92.5	6.59E+04	-0.53	2.5E+04		30.9	0.035
106-88-7	Epoxybutane 1,2-	72.1	9.5E+04 (e)	0.90 (e)				0.0331
110-80-5	Ethoxyethanol 2-	90.1	1.0E+06 (e)	-0.54	0	0	0	0.0308
111-15-9	Ethoxyethanol acetate 2-	132.2	2.29E+05 (g)	0.70 (g)	0	0	0	0.0252
141-78-6	Ethyl acetate	88.1	8.03E+04	0.35	3.5E+03		4.8E-03	3.4E+06

CAS	Constituent Name	Molecular Weight (g/mol) (a)	Solubility (mg/L) (b)	Log Koc (log[mL/g]) (c)	Hydrolysis Rate Constants (c)			Diffusion Coefficient in Water (Di) (m ² /yr) (d)
					Acid Catalyzed (Ka) (1/mol/yr)	Neutral (Kn) (1/yr)	Base Catalyzed (Kb) (1/mol/yr)	
60-29-7	Ethyl ether	74.1	5.68E+04	0.55	0	0	0	
97-63-2	Ethyl methacrylate	114.1	3.67E+03	1.27	0	0	1.1E+06	
62-50-0	Ethyl methanesulfonate	124.2	6.3E+03	-0.27	0	1.25E+03	0	
100-41-4	Ethylbenzene	106.2	169.00	3.00	0	0	0	0.0267
106-93-4	Ethylene dibromide (1,2-Dibromoethane)	187.9	4.18E+03	1.42	0	0.63	0	0.0331
107-21-1	Ethylene glycol	62.1	1.0E+06 (e)	-1.50	0	0	0	0.0429
75-21-8	Ethylene oxide	44.1	1.0E+06 (e)	-1.10	2.9E+05	21		0.046
96-45-7	Ethylene thiourea	102.2	6.2E+04	0.00	0	0	0	0.0319 (i)
206-44-0	Fluoranthene	202.3	0.21	4.63	0	0	0	
16984-48-8	Fluoride	19.0						
50-00-0	Formaldehyde	30.0	5.5E+05	-1.30	0	0	0	0.0549
64-18-6	Formic acid	46.0	1.0E+06 (e)	-2.70	0	0	0	
98-01-1	Furfural	96.1	1.1E+05	0.80 (j)	0	0	0	0.0337
319-85-7	HCH beta-	290.8	0.24	3.43	0	0	0	0.0233
58-89-9	HCH (Lindane) gamma-	290.8	6.80	3.40	0	1.05	1.7E+06	0.023
319-84-6	HCH alpha-	290.8	2.00	3.43	0	0	0	0.0232
76-44-8	Heptachlor	373.3	0.18	5.21	0	61	0	0.018
1024-57-3	Heptachlor epoxide	389.3	0.20	4.90	0	0.063	0	0.0176
87-68-3	Hexachloro-1,3-butadiene	260.8	3.23	4.46	0	0	0	0.0222
118-74-1	Hexachlorobenzene	284.8	0.01	5.41	0	0	0	0.0248
77-47-4	Hexachlorocyclopentadiene	272.8	1.80	4.72	0	24.8	0	0.0228
55684-94-1	Hexachlorodibenzofurans [HxCDFs]	374.9	8.25E-06 (f)	7.00	0	0	0	0.0133 (i)
34465-46-8	Hexachlorodibenzo-p-dioxins [HxCDDs]	390.9	4.0E-06 (f)	6.38 (g)	0	0	0	0.013 (i)
67-72-1	Hexachloroethane	236.7	50.00	3.61	0	0	0	0.028
70-30-4	Hexachlorophene	406.9	140.00	5.00	0	0	0	
110-54-3	Hexane n-	86.2	12.40	2.95 (k)	0	0	0	0.0256

CAS	Constituent Name	Molecular Weight (g/mol) (a)	Solubility (mg/L) (b)	Log Koc (log[mL/g]) (c)	Hydrolysis Rate Constants (c)			Diffusion Coefficient in Water (D) (m ² /yr) (d)
					Acid Catalyzed (Ka) (1/mol/yr)	Neutral (Kn) (1/yr)	Base Catalyzed (Kb) (1/mol/yr)	
7783-06-4	Hydrogen Sulfide	34.1	437.00		0	0	0	
193-39-5	Indeno{1,2,3-cd}pyrene	276.3	2.2E-05	6.26	0	0	0	0.0164 (i)
78-83-1	Isobutyl alcohol	74.1	8.5E+04	0.44	0	0	0	
78-59-1	Isophorone	138.2	1.2E+04	1.90	0	0	0	0.0238
143-50-0	Kepone	490.6	7.60	4.15	0	0	0	
7439-92-1	Lead	207.2						
7439-96-5	Manganese	54.9						
7439-97-6	Mercury	200.6	0.06					0.0949
126-98-7	Methacrylonitrile	67.1	25400.00	0.22	500	0	5.2E+03	0.0334
67-56-1	Methanol	32.0	1.0E+06 (e)	-1.08	0	0	0	0.052
72-43-5	Methoxychlor	345.7	0.05	4.90	0	0.69	1.2E+04	
109-86-4	Methoxyethanol 2-	76.1	1.0E+06 (e)	0.95 (e)	0	0	0	0.0347
110-49-6	Methoxyethanol acetate 2-	118.1	1.0E+06 (m)		0	0	0	0.0275
78-93-3	Methyl ethyl ketone	72.1	2.23E+05	-0.03	0	0	0	0.0322
108-10-1	Methyl isobutyl ketone	100.2	1.9E+04	0.87	0	0	0	0.0264
80-62-6	Methyl methacrylate	100.1	1.5E+04	0.74	0	0	0	0.0292
298-00-0	Methyl parathion	263.2	55.00	2.47		2.8		
1634-04-4	Methyl tert-butyl ether [MTBE]	88.1	5.13E+04 (e)	1.05 (e)	0	0	0	0.0272
56-49-5	Methylcholanthrene 3-	268.4	0.00	7.00	0	1.7E-02	0	0.0194
74-95-3	Methylene bromide (Dibromomethane)	173.8	1.19E+04	1.21	0	0	0	
75-09-2	Methylene Chloride (Dichloromethane)	84.9	1.3E+04	0.93	0	1.0E-03	0.6	0.0394
7439-98-7	Molybdenum	95.9						
91-20-3	Naphthalene	128.2	31.00	3.11	0	0	0	0.0264
7440-02-0	Nickel	58.7						
98-95-3	Nitrobenzene	123.1	2.09E+03	1.51	0	0	0	0.0298
79-46-9	Nitropropane 2-	89.1	1.7E+04	0.23	0	0	0	0.0322
55-18-5	Nitrosodiethylamine N-	102.1	9.3E+04	-0.03	0	0	0	0.0288

CAS	Constituent Name	Molecular Weight (g/mol) (a)	Solubility (mg/L) (b)	Log Koc (log[mL/g]) (c)	Hydrolysis Rate Constants (c)			Diffusion Coefficient in Water (D) (m ² /yr) (d)
					Acid Catalyzed (Ka) (1/mol/yr)	Neutral (Kn) (1/yr)	Base Catalyzed (Kb) (1/mol/yr)	
62-75-9	Nitrosodimethylamine N-	74.1	1.0E+06 (e)	0.45	0	0	0	0.0363
924-16-3	Nitroso-di-n-butylamine N-	158.2	1.27E+03	2.09	0	0	0	0.0215
621-64-7	Nitroso-di-n-propylamine N-	130.2	9.89E+03	1.03	0	0	0	0.0245
86-30-6	Nitrosodiphenylamine N-	198.2	35.10	2.84	0	0	0	0.0227
10595-95-6	Nitrosomethylethylamine N-	88.1	1.97E+04	1.03	0	0	0	0.0315
100-75-4	Nitrosopiperidine N-	114.1	7.65E+04	-0.02	0	0	0	0.029
930-55-2	Nitrosopyrrolidine N-	100.1	1.0E+06 (e)	-0.57	0	0	0	0.0319
152-16-9	Octamethyl pyrophosphoramide	286.3	1.0E+06 (m)	-0.51	1.9E+03			
56-38-2	Parathion (ethyl)	291.3	6.54	3.15	0	2.4	3.7E+06	
608-93-5	Pentachlorobenzene	250.3	1.33	5.39	0	0	0	
30402-15-4	Pentachlorodibenzofurans [PeCDFs]	340.4	2.40E-04 (f)	4.93 (g)	0	0	0	0.0142 (i)
36088-22-9	Pentachlorodibenzo-p-dioxins [PeCDDs]	356.4	1.18E-04 (f)	6.3 (g)	0	0	0	0.0138 (i)
82-68-8	Pentachloronitrobenzene (PCNB)	295.3	0.55	4.57	0	0	0	
87-86-5	Pentachlorophenol	266.3	1.95E+03	3.06	0	0	0	0.0253
108-95-2	Phenol	94.1	8.28E+04	1.23	0	0	0	0.0325
62-38-4	Phenyl mercuric acetate	336.7	2.0E+03	0.00	0	0	0	
108-45-2	Phenylenediamine 1,3-	108.1	2.55E+06	-0.30	0	0	0	
298-02-2	Phorate	260.4	50.00	2.64	0	62	0	
85-44-9	Phthalic anhydride	148.1	6.2E+03	1.56 (e)	0	4.9E+05	0	0.0308
1336-36-3	Polychlorinated biphenyls (Aroclors)		0.07	6.19	0	0	0	0.0189
23950-58-5	Pronamide	256.1	32.80	2.63	59	0	610	
75-56-9	Propylene oxide [1,2-Epoxypropane]	58.1	4.05E+05 (e)	1.40 (e)	0	0	0	0.0382
129-00-0	Pyrene	202.3	0.14	4.92	0	0	0	
110-86-1	Pyridine	79.1	1.0E+06 (e)	0.34	0	0	0	0.0344
94-59-7	Safrole	162.2	810.67	2.34	0	0	0	

CAS	Constituent Name	Molecular Weight (g/mol) (a)	Solubility (mg/L) (b)	Log Koc (log[mL/g]) (c)	Hydrolysis Rate Constants (c)			Diffusion Coefficient in Water (Di) (m ² /yr) (d)
					Acid Catalyzed (Ka) (1/mol/yr)	Neutral (Kn) (1/yr)	Base Catalyzed (Kb) (1/mol/yr)	
7782-49-2	Selenium	79.0						
7440-22-4	Silver	107.9						
57-24-9	Strychnine and salts	334.4	160.00	1.90	0	0	0	
100-42-5	Styrene	104.2	310.00	2.84	0	0	0	0.0278
95-94-3	Tetrachlorobenzene 1,2,4,5-	215.9	0.60	4.28	0	0	0	
51207-31-9	Tetrachlorodibenzofuran 2,3,7,8-	306.0	6.92E-04 (f)	6.62	0	0	0	0.0153 (i)
1746-01-6	Tetrachlorodibenzo-p-dioxin 2,3,7,8-	322.0	7.91E-06 (f)	6.10	0	0	0	0.0148 (i)
630-20-6	Tetrachloroethane 1,1,1,2-	167.8	1.1E+03	2.71	0	0.0137	1.13E+04	0.0287
79-34-5	Tetrachloroethane 1,1,2,2-	167.8	2.97E+03	2.07	0	5.1E-03	1.59E+07	0.0293
127-18-4	Tetrachloroethylene	165.8	200.00	2.21	0	0	0	0.0298
58-90-2	Tetrachlorophenol 2,3,4,6-	231.9	100.00	2.32	0	0	0	
3689-24-5	Tetraethyl dithiopyrophosphate (Sulfotep)	322.3	25.00	3.51	0	84	9.0E+06	
7440-28-0	Thallium	204.4						
137-26-8	Thiram [Thiuram]	240.4	30.00	2.83 (e)	0	0	0	
108-88-3	Toluene	92.1	526.00	2.43	0	0	0	0.0291
95-80-7	Toluenediamine 2,4-	122.2	3.37E+04	0.02	0	0	0	0.0282 (i)
95-53-4	Toluidine o-	107.2	1.66E+04	1.24	0	0	0	0.029
106-49-0	Toluidine p-	107.2	782.00	1.24	0	0	0	
8001-35-2	Toxaphene (chlorinated camphenes)		0.74	4.31	0	0.07	2.8E+04	0.0173
75-25-2	Tribromomethane (Bromoform)	252.7	3.1E+03	2.05			1.0E+04	0.0328
76-13-1	Trichloro-1,2,2-trifluoro-ethane 1,1,2-	187.4	170.00	2.97	0	0	0	0.0271
120-82-1	Trichlorobenzene 1,2,4-	181.4	34.60	3.96	0	0	0	0.0265
71-55-6	Trichloroethane 1,1,1-	133.4	1.33E+03	2.16	0	0.64	2.4E+06	0.0303
79-00-5	Trichloroethane 1,1,2-	133.4	4.42E+03	1.73	0	2.73E-05	4.95E+04	0.0315
79-01-6	Trichloroethylene (Trichloroethylene 1,1,2-)	131.4	1.1E+03	2.10	0	0	0	0.0322

CAS	Constituent Name	Molecular Weight (g/mol) (a)	Solubility (mg/L) (b)	Log Koc (log[mL/g]) (c)	Hydrolysis Rate Constants (c)			Diffusion Coefficient in Water (D) (m ² /yr) (d)
					Acid Catalyzed (Ka) (1/mol/yr)	Neutral (Kn) (1/yr)	Base Catalyzed (Kb) (1/mol/yr)	
75-69-4	Trichlorofluoromethane (Freon 11)	137.4	1.1E+03	2.11	0	0	0	0.0319
95-95-4	Trichlorophenol 2,4,5-	197.4	1.2E+03	2.93	0	0	0	
88-06-2	Trichlorophenol 2,4,6-	197.4	800.00	2.25	0	0	0	0.0255
93-72-1	Trichlorophenoxy)propionic acid 2-(2,4,5-	269.5	140.00	1.74	0	0	0	
93-76-5	Trichlorophenoxyacetic acid 2,4,5-	255.5	268.30	1.43	0	0	0	
96-18-4	Trichloropropane 1,2,3-	147.4	1.75E+03	1.66	0	1.7E-02	3.6E+03	0.0291
121-44-8	Triethylamine	101.2	5.5E+04 (e)	1.31 (l)	0	0	0	0.0247
99-35-4	Trinitrobenzene (Trinitrobenzene 1,3,5-)	213.1	350.00	1.05	0	0	0	
126-72-7	Tris(2,3-dibromopropyl)phosphate	697.6	8.00	3.19	0	8.8E-02	3.0E+05	
7440-62-2	Vanadium	50.9						
108-05-4	Vinyl acetate	86.1	2.0E+04	0.45	0	0	0	0.0315
75-01-4	Vinyl chloride	62.5	2.76E+03	1.04	0	0	0	0.0378
108-38-3	Xylene m-	106.2	161.00	3.09	0	0	0	0.0267
95-47-6	Xylene o-	106.2	178.00	3.02	0	0	0	0.027
106-42-3	Xylene p-	106.2	185.00	3.12	0	0	0	0.0267
1330-20-7	Xylenes (total)	318.5	175.00	3.08	0	0	0	0.0268
7440-66-6	Zinc	65.4						

Note: Data sources for chemical property values are indicated in the column headings; exceptions are noted in parentheses for individual chemical values.

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APPENDIX D

WMU AND HYDROGEOLOGIC ENVIRONMENT DATABASES

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Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
1	3.04E+04	-999	12.5	1	69	1.00
2	2.97E+04	3.12	22.5	5	92	1.00
3	1.35E+04	0.67	22.5	4	58	1.00
4	4.05E+04	1.47	17.5	4	93	1.00
5	2.02E+04	3.85	12.5	2	51	1.00
6	4.45E+05	7.68	12.5	12	85	1.00
7	3.84E+04	0.86	12.5	4	74	1.00
8	1.11E+05	2.08	12.5	2	39	1.00
9	3.24E+04	4.30	12.5	5	51	1.00
10	1.21E+04	0.74	22.5	4	58	1.00
11	6.15E+05	1.02	7.5	2	32	1.00
12	1.63E+04	-999	17.5	13	90	1.00
13	2.02E+04	-999	12.5	12	42	19.63
14	3.04E+04	-999	12.5	1	69	19.63
15	1.21E+04	-999	22.5	4	81	2.69
16	8.09E+04	-999	17.5	2	36	2.69
17	2.02E+03	-999	17.5	1	95	2.69
18	6.07E+04	3.17	12.5	2	39	2.69
19	6.07E+04	0.76	17.5	13	34	2.69
20	1.21E+04	0.68	12.5	12	54	2.69
21	9.31E+03	-999	17.5	1	95	2.69
22	8.09E+03	1.22	17.5	12	89	2.69
23	2.02E+05	1.31	17.5	12	95	2.69
24	3.24E+04	7.67	17.5	4	89	2.69
25	4.05E+04	-999	17.5	5	13	2.69
26	4.86E+03	1.36	12.5	2	39	2.69
27	2.02E+02	-999	7.5	4	43	2.69
28	4.05E+03	4.09	7.5	2	66	2.69
29	2.02E+03	4.42	12.5	4	36	2.69
30	5.06E+03	-999	17.5	2	36	2.69
31	2.02E+04	-999	22.5	12	78	2.69
32	4.86E+04	1.19	17.5	12	85	2.69
33	1.21E+04	6.82	17.5	4	95	2.69
34	6.07E+04	1.78	17.5	5	89	1.00
35	1.09E+05	1.52	12.5	2	74	1.00
36	1.21E+05	-999	12.5	9	42	1.00
37	2.43E+04	1.01	22.5	4	91	1.00
38	1.42E+05	0.69	12.5	4	71	1.00
39	4.05E+03	1.23	12.5	4	39	1.00
40	6.88E+04	1.83	12.5	12	54	1.00
41	3.04E+04	-999	12.5	5	51	1.00
42	3.35E+05	-999	12.5	4	52	1.00
43	2.71E+03	3.05	7.5	4	45	1.00
44	6.07E+04	3.00	7.5	13	49	1.00
45	2.02E+06	2.83	12.5	12	88	1.00
46	1.42E+04	1.17	22.5	4	96	1.00
47	1.42E+04	-999	12.5	2	39	1.00

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
48	8.09E+03	7.90	17.5	13	34	1.00
49	8.09E+04	0.55	7.5	4	60	1.00
50	4.05E+04	2.86	17.5	12	85	1.00
51	5.26E+04	2.05	7.5	2	32	1.00
52	2.02E+04	0.98	12.5	8	32	1.00
53	1.01E+05	2.45	12.5	4	52	1.00
54	3.97E+04	2.38	12.5	2	39	1.00
55	1.11E+05	7.47	17.5	12	95	1.00
56	1.34E+04	0.84	12.5	9	73	1.00
57	4.86E+04	-999	12.5	1	71	1.00
58	1.27E+05	1.01	12.5	12	50	1.00
59	9.47E+04	1.75	12.5	1	71	1.00
60	6.07E+04	0.87	12.5	4	71	1.00
61	3.32E+05	5.24	17.5	5	13	1.00
62	2.23E+04	2.02	12.5	5	56	1.00
63	6.96E+04	-999	17.5	12	95	1.00
64	6.07E+04	-999	17.5	1	77	1.00
65	6.88E+04	3.32	12.5	8	75	1.00
66	4.05E+03	2.05	17.5	4	93	1.00
67	5.26E+05	3.64	12.5	4	49	1.00
68	2.87E+04	1.93	17.5	2	36	1.00
69	4.05E+04	7.65	12.5	2	39	1.00
70	7.28E+04	-999	7.5	8	48	1.00
71	1.72E+05	-999	12.5	4	72	1.00
72	1.01E+04	5.37	17.5	12	95	1.00
73	3.14E+04	4.83	12.5	5	3	1.00
74	1.07E+05	5.56	12.5	4	51	1.00
75	5.06E+04	1.77	12.5	2	39	1.00
76	6.92E+04	5.09	17.5	4	23	1.00
77	1.42E+05	-999	12.5	12	71	1.00
78	1.94E+04	1.28	12.5	12	69	1.00
79	7.16E+04	3.93	12.5	9	32	1.00
80	9.31E+04	-999	17.5	12	85	1.00
81	3.24E+05	1.84	12.5	12	42	1.00
82	3.72E+05	-999	12.5	2	69	1.00
83	1.21E+03	3.15	17.5	5	34	1.00
84	4.17E+03	2.78	17.5	2	95	1.00
85	2.51E+05	-999	12.5	12	73	1.00
86	1.35E+05	6.55	12.5	9	42	1.00
87	1.66E+03	7.98	12.5	9	73	1.00
88	1.35E+05	4.09	22.5	4	81	1.00
89	8.09E+04	1.53	12.5	5	40	1.00
90	2.55E+05	7.79	12.5	2	71	1.00
91	4.57E+04	-999	12.5	1	71	1.00
92	3.24E+03	-999	12.5	2	39	1.00
93	2.10E+05	1.26	7.5	13	68	1.00
94	5.67E+04	2.51	12.5	2	52	1.00

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
95	5.67E+02	1.29	22.5	12	91	1.00
96	5.54E+05	0.53	12.5	5	26	1.00
97	2.43E+04	4.09	12.5	4	39	1.00
98	9.79E+05	0.54	12.5	12	49	1.00
99	5.26E+04	1.13	17.5	2	95	1.00
100	2.19E+05	3.12	12.5	2	71	1.00
101	2.83E+04	2.34	12.5	2	39	1.00
102	8.09E+03	-999	17.5	1	95	1.00
103	2.27E+05	-999	12.5	12	42	1.00
104	4.05E+03	2.95	12.5	2	53	1.00
105	8.50E+04	2.18	22.5	12	93	1.00
106	7.08E+04	-999	12.5	9	42	1.00
107	2.02E+04	6.71	12.5	12	42	1.00
108	2.43E+04	0.82	7.5	4	66	1.25
109	8.09E+03	-999	17.5	12	95	1.25
110	3.28E+03	1.52	12.5	12	69	1.25
111	1.34E+05	1.99	7.5	13	4	1.25
112	1.62E+04	3.07	12.5	2	88	1.25
113	3.64E+04	1.19	17.5	1	77	1.25
114	4.05E+05	-999	12.5	9	73	1.25
115	2.02E+05	1.31	12.5	12	55	1.25
116	8.09E+02	-999	7.5	13	68	16.22
117	3.24E+04	-999	22.5	12	57	1.00
118	4.86E+04	1.58	22.5	4	92	1.00
119	8.50E+02	-999	12.5	12	50	1.00
120	4.86E+04	-999	22.5	12	91	1.00
121	5.14E+05	-999	7.5	13	5	1.00
122	3.12E+06	-999	22.5	4	92	1.00
123	8.09E+04	-999	12.5	12	71	1.00
124	1.30E+04	1.98	17.5	12	95	1.00
125	2.02E+04	-999	22.5	12	57	1.00
126	4.17E+03	-999	22.5	12	93	1.00
127	2.02E+03	-999	17.5	4	29	1.00
128	1.41E+06	-999	22.5	5	92	1.00
129	1.17E+04	0.65	22.5	13	96	1.00
130	6.07E+04	-999	17.5	4	81	1.00
131	2.23E+05	-999	12.5	2	39	22.01
132	4.05E+04	3.96	22.5	4	92	2.55
133	4.05E+02	-999	17.5	2	36	2.55
134	8.09E+04	-999	17.5	2	89	2.55
135	2.27E+04	5.41	12.5	5	33	2.55
136	2.02E+02	1.36	22.5	13	92	2.55
137	2.14E+05	4.82	7.5	8	31	2.55
138	1.54E+05	-999	22.5	12	78	2.55
139	2.71E+04	0.99	7.5	2	31	1.00
140	8.09E+05	8.18	12.5	2	39	1.00
141	1.00E+06	2.35	22.5	4	58	1.00

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
142	7.08E+05	4.24	12.5	5	26	1.00
143	7.16E+05	2.14	17.5	13	90	1.00
144	2.02E+04	-999	12.5	2	52	1.00
145	2.54E+05	2.09	17.5	4	80	1.00
146	1.01E+05	-999	12.5	6	89	1.00
147	2.02E+04	-999	22.5	12	58	1.00
148	5.26E+04	1.01	12.5	2	28	1.00
149	5.26E+02	2.03	22.5	4	96	1.00
150	1.86E+05	1.72	12.5	4	27	1.00
151	6.07E+04	-999	12.5	1	72	1.00
152	2.23E+04	1.36	12.5	5	4	1.00
153	1.72E+06	-999	12.5	2	39	1.00
154	1.21E+05	0.65	22.5	2	91	1.00
155	2.63E+05	-999	12.5	13	73	1.00
156	1.86E+05	-999	12.5	12	73	1.00
157	5.67E+04	-999	12.5	12	42	1.00
158	7.69E+05	3.75	12.5	8	55	1.00
159	1.21E+05	4.36	12.5	2	39	1.00
160	1.62E+06	-999	12.5	5	51	1.00
161	8.09E+03	2.62	12.5	1	63	1.00
162	3.44E+04	6.26	12.5	4	72	1.00
163	6.27E+05	6.55	12.5	2	39	1.00
164	2.23E+04	1.26	17.5	2	93	1.00
165	2.43E+04	1.21	17.5	13	77	1.00
166	4.45E+04	-999	12.5	5	29	1.00
167	1.50E+04	1.58	17.5	12	95	1.00
168	1.97E+06	-999	22.5	4	96	1.00
169	1.21E+06	6.00	12.5	12	49	1.00
170	1.24E+06	2.81	7.5	2	32	1.00
171	2.02E+06	3.96	22.5	4	81	1.00
172	5.10E+05	-999	12.5	2	51	1.00
173	4.86E+04	0.55	12.5	4	40	1.00
174	3.24E+04	-999	22.5	4	92	1.00
175	5.54E+05	-999	12.5	13	56	1.00
176	8.09E+05	7.26	22.5	5	22	1.00
177	8.09E+03	-999	17.5	12	89	1.00
178	2.51E+04	0.96	7.5	1	31	1.00
179	1.62E+06	6.14	7.5	13	49	1.00
180	1.62E+05	-999	7.5	2	11	1.00
181	6.75E+04	1.95	12.5	12	20	1.00
182	2.59E+05	0.76	17.5	4	92	1.00
183	2.67E+05	4.20	17.5	13	34	1.00
184	1.62E+05	7.06	22.5	4	58	1.00
185	2.23E+05	6.32	12.5	2	51	1.00
186	4.65E+03	0.66	7.5	2	7	1.00
187	1.01E+06	-999	12.5	13	73	1.00
188	8.05E+05	1.64	12.5	5	74	1.00

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
189	1.86E+06	4.55	12.5	5	51	1.00
190	1.18E+06	6.66	22.5	4	36	1.00
191	2.02E+03	1.32	17.5	2	36	1.00
192	9.92E+04	5.01	12.5	2	85	1.00
193	7.16E+05	2.14	17.5	5	90	1.00
194	1.23E+05	4.29	7.5	4	10	1.00
195	1.46E+04	-999	12.5	9	42	1.00
196	1.66E+05	-999	17.5	4	95	1.00
197	1.62E+04	-999	17.5	4	93	1.00
198	7.08E+05	4.24	12.5	5	26	1.00
199	9.29E+04	-999	17.5	2	89	1.00
200	5.26E+05	3.55	22.5	4	36	1.00
201	1.48E+06	-999	17.5	4	81	1.00
202	6.48E+03	0.51	12.5	12	71	1.00
203	2.02E+04	6.55	12.5	12	87	1.00
204	4.87E+05	-999	12.5	4	51	1.00
205	5.46E+04	5.11	7.5	5	10	1.00
206	1.66E+05	5.99	12.5	8	55	1.00
207	1.21E+05	5.28	17.5	13	34	1.00
208	4.05E+03	1.32	12.5	12	69	1.38
209	1.69E+06	4.98	17.5	4	93	1.38
210	1.25E+05	3.32	12.5	12	54	1.38
211	5.67E+04	1.32	12.5	13	73	1.38
212	2.02E+03	-999	22.5	5	12	1.38
213	4.53E+05	8.04	7.5	4	7	1.38
214	4.05E+03	-999	22.5	4	81	1.38
215	4.05E+04	4.91	12.5	12	19	1.38
216	2.02E+04	-999	7.5	13	10	1.38
217	1.82E+05	3.64	12.5	2	39	1.38
218	1.21E+05	-999	22.5	4	92	1.00
219	8.50E+02	-999	17.5	13	77	7.56
220	9.31E+02	-999	17.5	1	79	7.56
221	2.83E+04	-999	22.5	4	58	1.05
222	7.29E+02	2.36	17.5	4	89	1.00
223	1.42E+04	3.27	17.5	4	80	1.00
224	8.09E+04	4.11	12.5	5	74	1.00
225	8.09E+04	1.23	12.5	12	69	1.00
226	1.66E+04	5.39	12.5	1	77	1.00
227	8.90E+04	1.39	17.5	13	29	1.00
228	2.02E+04	-999	22.5	4	58	1.00
229	8.90E+03	1.23	22.5	4	96	1.00
230	3.24E+04	1.33	12.5	6	73	1.00
231	5.67E+04	2.63	17.5	2	30	1.00
232	4.05E+04	-999	22.5	12	57	1.00
233	6.48E+04	2.76	12.5	4	88	1.00
234	5.67E+02	0.88	17.5	4	89	1.81
235	1.11E+04	-999	12.5	12	85	1.81

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
236	7.90E+04	-999	12.5	12	55	1.81
237	4.45E+02	1.12	12.5	13	16	1.81
238	4.05E+03	2.45	12.5	5	39	1.81
239	1.62E+04	-999	17.5	12	95	1.81
240	1.01E+04	-999	12.5	12	54	1.81
241	4.86E+04	-999	12.5	1	88	1.81
242	4.86E+04	-999	12.5	4	71	1.81
243	1.05E+05	-999	17.5	13	34	1.81
244	1.38E+03	3.57	22.5	12	93	1.81
245	1.11E+04	2.20	12.5	4	72	1.81
246	1.94E+04	-999	12.5	12	89	1.00
247	7.69E+04	3.70	17.5	12	89	1.00
248	2.94E+04	-999	17.5	5	13	1.00
249	3.64E+03	3.64	17.5	1	85	1.00
250	4.05E+02	6.55	12.5	1	72	1.00
251	2.02E+04	-999	22.5	4	92	1.00
252	3.80E+04	0.52	22.5	4	35	1.00
253	2.12E+03	-999	17.5	5	89	1.00
254	6.75E+04	1.10	17.5	4	79	1.00
255	4.43E+03	1.03	17.5	12	85	1.00
256	2.63E+04	-999	12.5	4	74	1.00
257	2.02E+04	-999	12.5	13	26	1.00
258	4.25E+04	2.44	17.5	4	93	1.00
259	2.02E+04	-999	22.5	12	57	1.00
260	2.83E+04	3.51	12.5	12	69	1.00
261	6.88E+04	1.20	12.5	4	72	1.00
262	2.02E+04	1.27	22.5	4	81	1.00
263	3.89E+04	3.47	17.5	12	89	1.00
264	2.43E+04	2.97	17.5	12	85	1.00
265	2.63E+05	1.35	17.5	4	89	1.00
266	8.09E+04	1.31	22.5	4	96	1.00
267	1.38E+04	1.14	22.5	4	81	1.00
268	5.22E+03	1.08	12.5	12	49	1.00
269	6.39E+05	-999	12.5	2	87	1.00
270	2.02E+04	0.65	12.5	5	34	1.00
271	1.01E+04	-999	7.5	4	60	1.00
272	7.04E+04	-999	12.5	9	42	1.00
273	3.64E+04	0.68	22.5	12	78	1.00
274	8.09E+03	-999	22.5	12	93	1.00
275	3.24E+04	-999	17.5	13	90	1.00
276	9.29E+04	-999	17.5	4	29	1.00
277	4.04E+04	1.06	12.5	5	40	1.00
278	6.21E+04	1.02	12.5	13	26	1.00
279	5.79E+03	0.80	22.5	4	92	1.00
280	2.02E+04	3.54	22.5	4	81	1.00
281	6.52E+03	1.27	12.5	2	51	1.00
282	8.13E+04	-999	22.5	4	96	1.00

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
283	5.26E+04	-999	17.5	5	13	1.00
284	2.12E+06	-999	22.5	5	92	1.00
285	6.07E+04	0.65	17.5	13	81	1.00
286	9.31E+04	2.67	22.5	4	92	1.00
287	2.67E+04	-999	22.5	4	35	1.00
288	4.00E+04	0.69	12.5	4	51	1.00
289	4.05E+04	-999	17.5	5	13	1.00
290	2.23E+04	-999	22.5	12	78	1.00
291	2.02E+04	4.09	7.5	13	5	1.00
292	6.88E+04	8.02	22.5	4	96	1.00
293	3.72E+04	1.33	17.5	4	89	1.00
294	4.35E+04	4.22	17.5	12	89	1.00
295	6.07E+04	2.73	12.5	2	69	1.00
296	8.62E+04	-999	12.5	5	87	1.00
297	6.07E+04	-999	17.5	13	81	1.38
298	2.79E+03	1.98	22.5	6	92	1.38
299	4.05E+03	1.82	17.5	1	77	1.38
300	1.21E+03	-999	12.5	4	72	29.81
301	8.09E+03	-999	22.5	4	92	29.81
302	1.21E+04	-999	12.5	8	42	29.81
303	8.09E+04	4.09	12.5	4	52	29.81
304	1.86E+03	-999	12.5	9	56	29.81
305	8.09E+01	3.03	17.5	1	77	29.81
306	2.02E+03	1.23	22.5	4	91	29.81
307	2.02E+04	-999	22.5	5	21	29.81
308	3.72E+03	0.89	7.5	8	45	29.81
309	8.09E+03	-999	22.5	4	92	29.81
310	2.43E+02	2.05	17.5	12	85	29.81
311	9.31E+02	7.12	12.5	8	46	29.81
312	1.01E+04	-999	12.5	12	73	29.81
313	1.01E+04	-999	22.5	12	57	29.81
314	2.02E+04	1.02	12.5	12	39	29.81
315	8.09E+03	0.61	12.5	5	3	29.81
316	8.09E+01	-999	22.5	12	58	29.81
317	1.62E+05	-999	17.5	13	77	9.25
318	4.05E+04	2.45	22.5	4	92	9.25
319	2.02E+02	-999	17.5	13	1	9.25
320	1.01E+03	-999	17.5	1	95	9.25
321	1.21E+04	-999	22.5	12	57	9.25
322	1.62E+03	-999	12.5	4	19	9.25
323	2.63E+04	4.56	17.5	4	79	9.25
324	6.07E+04	5.46	12.5	13	86	9.25
325	4.05E+03	0.82	12.5	12	42	9.25
326	2.02E+03	-999	17.5	4	89	9.25
327	8.09E+03	-999	17.5	5	34	9.25
328	2.47E+04	-999	12.5	1	84	9.25
329	4.05E+04	-999	12.5	4	74	9.25

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
330	6.07E+03	-999	17.5	12	89	9.25
331	8.90E+04	4.09	17.5	5	21	9.25
332	4.45E+02	1.38	12.5	13	29	9.25
333	2.43E+04	3.07	17.5	4	80	9.25
334	6.07E+03	5.73	12.5	4	39	9.25
335	4.05E+03	0.74	17.5	13	34	9.25
336	2.83E+02	2.60	7.5	13	66	9.25
337	2.43E+04	5.11	12.5	2	51	9.25
338	4.05E+01	0.91	22.5	12	76	9.25
339	2.83E+04	4.09	12.5	12	73	9.25
340	4.05E+04	1.32	17.5	13	36	9.25
341	6.07E+04	-999	17.5	1	95	9.25
342	4.05E+03	2.05	17.5	2	36	9.25
343	4.05E+03	1.23	7.5	4	5	9.25
344	9.31E+02	3.69	12.5	2	88	9.25
345	2.02E+02	-999	12.5	9	73	9.25
346	3.90E+04	3.98	7.5	2	31	9.25
347	8.09E+03	-999	17.5	12	85	9.25
348	1.14E+04	0.79	17.5	12	95	9.25
349	6.07E+04	-999	7.5	12	48	9.25
350	2.23E+04	0.77	12.5	4	88	9.25
351	3.04E+03	2.73	17.5	1	79	9.25
352	8.09E+03	-999	17.5	1	79	9.25
353	1.21E+03	-999	22.5	12	57	9.25
354	8.09E+03	-999	17.5	4	95	9.25
355	8.09E+03	-999	17.5	1	95	9.25
356	1.01E+04	0.92	12.5	8	56	9.25
357	4.05E+03	-999	22.5	4	81	9.25
358	4.86E+04	1.26	12.5	2	52	9.25
359	4.05E+01	-999	17.5	5	90	9.25
360	2.43E+04	-999	12.5	8	55	1.00
361	8.09E+03	-999	17.5	4	80	1.00
362	6.07E+03	1.09	22.5	4	12	1.00
363	4.05E+04	-999	22.5	13	12	1.00
364	1.43E+04	1.45	17.5	5	13	1.00
365	1.16E+04	-999	12.5	2	39	1.00
366	8.82E+03	2.38	12.5	5	51	1.00
367	4.05E+04	3.17	12.5	4	51	1.00
368	8.09E+03	6.60	12.5	2	52	1.00
369	4.46E+04	3.97	17.5	1	79	1.00
370	4.05E+03	5.11	22.5	4	96	1.00
371	1.42E+04	-999	22.5	4	12	1.00
372	1.09E+04	4.55	7.5	13	66	1.00
373	3.72E+04	4.46	12.5	5	40	1.00
374	2.55E+04	2.79	7.5	4	60	1.00
375	4.45E+05	5.58	17.5	2	36	1.00
376	2.43E+05	6.82	7.5	4	68	1.00

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
377	6.07E+03	6.87	7.5	13	66	1.00
378	6.07E+03	4.09	12.5	4	72	1.00
379	8.09E+03	0.61	17.5	12	89	1.00
380	8.09E+03	3.27	22.5	2	58	1.00
381	5.77E+04	2.77	17.5	1	77	1.00
382	3.24E+05	7.16	7.5	12	50	1.00
383	3.75E+04	-999	12.5	1	61	1.00
384	4.25E+02	-999	7.5	13	66	1.00
385	4.86E+05	-999	7.5	8	48	1.00
386	5.67E+04	1.05	17.5	10	79	1.00
387	1.26E+05	-999	22.5	4	12	1.00
388	8.09E+03	0.59	12.5	1	61	1.00
389	2.83E+04	3.11	7.5	2	50	1.00
390	2.63E+05	3.78	12.5	12	42	1.00
391	1.62E+05	4.50	17.5	4	79	1.00
392	1.38E+03	3.01	12.5	2	71	1.00
393	1.62E+05	2.56	17.5	5	21	1.00
394	1.05E+05	-999	12.5	12	49	1.00
395	1.02E+04	3.83	12.5	4	39	1.00
396	4.45E+03	3.95	12.5	12	71	1.00
397	1.82E+04	7.07	12.5	2	66	1.00
398	3.24E+04	0.77	12.5	13	72	1.00
399	3.84E+05	6.46	12.5	4	51	1.00
400	4.86E+04	5.11	12.5	12	39	1.00
401	2.23E+05	5.28	22.5	4	14	1.00
402	2.23E+04	1.12	12.5	12	54	1.00
403	5.67E+04	-999	12.5	2	55	1.00
404	1.01E+05	5.24	17.5	2	36	1.00
405	4.05E+03	-999	22.5	12	58	1.00
406	1.01E+04	-999	17.5	5	13	1.00
407	3.91E+04	2.93	17.5	4	89	1.00
408	1.01E+04	-999	17.5	5	34	1.00
409	9.31E+04	1.78	17.5	12	85	1.00
410	1.67E+04	2.18	12.5	4	39	1.00
411	1.62E+04	-999	12.5	12	49	1.00
412	8.09E+04	-999	17.5	4	79	1.00
413	1.21E+04	-999	12.5	2	39	1.00
414	1.16E+04	-999	12.5	5	39	1.00
415	2.79E+04	2.20	17.5	13	90	1.00
416	2.31E+04	-999	12.5	2	39	1.00
417	1.63E+04	3.81	22.5	13	36	1.00
418	8.09E+03	-999	12.5	2	39	1.33
419	1.27E+04	-999	12.5	12	77	1.33
420	4.45E+04	-999	17.5	4	30	1.33
421	2.59E+03	8.31	12.5	4	52	1.33
422	4.86E+03	3.20	12.5	5	26	1.33
423	8.09E+03	0.82	17.5	2	89	1.33

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
424	2.02E+03	-999	17.5	13	36	1.33
425	5.26E+02	1.87	12.5	2	52	1.33
426	3.48E+04	-999	7.5	13	39	1.33
427	5.26E+04	-999	7.5	5	10	1.33
428	2.17E+05	0.53	12.5	5	87	1.33
429	4.05E+04	-999	17.5	12	95	1.33
430	1.21E+05	2.18	17.5	13	34	1.33
431	7.35E+04	6.76	12.5	4	74	1.33
432	2.23E+04	4.46	17.5	12	95	1.33
433	8.09E+03	-999	22.5	2	36	1.33
434	4.05E+03	-999	22.5	4	92	1.33
435	4.05E+04	-999	12.5	2	54	1.33
436	1.21E+05	-999	12.5	5	56	1.33
437	1.05E+05	5.35	12.5	2	53	1.33
438	3.72E+03	1.13	12.5	2	51	1.33
439	3.44E+04	-999	17.5	4	81	1.33
440	2.43E+04	-999	17.5	2	30	1.33
441	8.09E+03	-999	12.5	12	85	1.33
442	6.07E+04	-999	17.5	5	54	1.33
443	2.02E+04	2.05	12.5	13	72	1.33
444	4.05E+03	-999	17.5	1	95	1.33
445	5.26E+03	-999	17.5	5	12	1.33
446	2.43E+05	3.48	12.5	9	73	1.33
447	2.83E+02	-999	22.5	12	57	1.33
448	7.53E+04	0.79	17.5	13	37	1.33
449	1.21E+04	-999	22.5	12	58	1.33
450	6.07E+03	-999	12.5	1	72	1.33
451	1.21E+04	-999	7.5	12	53	1.33
452	4.86E+03	0.81	12.5	2	39	1.33
453	8.09E+03	-999	12.5	12	49	1.33
454	1.98E+05	-999	12.5	12	71	1.33
455	4.86E+04	5.11	12.5	2	88	1.33
456	4.05E+04	-999	12.5	2	50	1.33
457	8.09E+03	-999	12.5	4	74	1.33
458	3.36E+03	-999	7.5	2	53	1.33
459	2.02E+06	-999	7.5	2	53	1.33
460	6.07E+03	-999	22.5	2	58	1.33
461	9.07E+04	5.11	12.5	13	73	1.33
462	3.24E+03	-999	22.5	4	12	1.33
463	2.02E+04	-999	12.5	12	42	1.33
464	4.05E+04	-999	7.5	8	65	1.33
465	1.01E+05	1.28	17.5	4	79	1.33
466	3.34E+04	7.93	17.5	12	85	1.33
467	3.24E+05	2.64	17.5	2	36	1.33
468	7.45E+03	-999	17.5	12	95	1.33
469	1.05E+05	0.97	12.5	12	88	1.33
470	3.24E+04	-999	17.5	13	37	1.33

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
471	2.70E+04	2.28	17.5	13	34	1.33
472	3.24E+05	1.53	17.5	4	30	1.33
473	4.86E+04	-999	12.5	13	68	1.33
474	3.04E+04	4.58	12.5	13	56	1.33
475	2.43E+04	-999	17.5	13	37	1.33
476	1.86E+04	-999	12.5	2	51	1.33
477	1.56E+05	2.92	12.5	13	56	1.33
478	4.86E+05	0.53	7.5	2	17	1.33
479	4.05E+04	1.31	12.5	2	51	1.33
480	2.32E+04	3.56	17.5	13	13	1.00
481	1.66E+05	-999	7.5	13	3	1.00
482	2.02E+04	-999	12.5	12	69	1.00
483	1.21E+05	0.55	17.5	2	30	1.00
484	5.46E+04	3.54	12.5	4	74	7.48
485	1.49E+05	4.45	7.5	13	50	7.48
486	1.92E+04	1.49	22.5	4	92	7.48
487	1.82E+04	1.27	12.5	8	46	7.48
488	6.07E+03	6.78	12.5	4	74	7.48
489	1.30E+05	-999	17.5	5	90	7.48
490	3.44E+04	-999	12.5	7	29	7.48
491	3.64E+04	1.59	12.5	5	24	7.48
492	5.18E+04	2.56	22.5	4	96	1.00
493	5.26E+04	1.06	17.5	4	79	1.00
494	1.34E+05	6.20	7.5	1	44	1.00
495	5.87E+04	0.56	17.5	4	93	1.00
496	3.52E+05	2.63	7.5	1	31	1.00
497	2.19E+05	-999	22.5	4	92	1.00
498	7.08E+04	-999	22.5	4	96	1.00
499	7.32E+04	-999	7.5	4	31	1.00
500	4.05E+05	0.63	22.5	13	81	1.00
501	3.84E+04	1.94	7.5	2	50	1.00
502	1.75E+04	2.52	22.5	12	92	1.00
503	1.79E+05	2.83	12.5	12	69	1.00
504	8.09E+04	-999	17.5	4	92	1.00
505	1.84E+05	3.15	17.5	12	89	1.00
506	4.05E+04	2.89	17.5	1	95	1.00
507	2.52E+06	1.77	17.5	13	34	1.00
508	1.21E+05	-999	17.5	4	93	1.00
509	1.58E+05	2.35	7.5	2	31	1.00
510	1.36E+04	1.42	17.5	2	87	1.00
511	6.88E+03	3.95	22.5	12	78	1.00
512	1.05E+05	7.87	22.5	12	78	1.00
513	7.01E+04	2.00	22.5	12	91	1.00
514	2.02E+05	-999	17.5	12	85	1.00
515	1.92E+06	0.79	17.5	4	93	1.00
516	2.43E+04	-999	22.5	4	92	1.00
517	1.62E+05	-999	17.5	4	92	1.00

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
518	1.21E+05	2.18	7.5	4	50	1.00
519	1.82E+05	0.84	7.5	13	43	1.00
520	1.24E+04	1.94	17.5	4	90	1.00
521	1.62E+05	-999	17.5	2	80	1.00
522	3.72E+05	1.32	22.5	12	78	1.00
523	1.78E+05	4.65	12.5	2	28	1.00
524	8.09E+04	-999	12.5	2	66	1.00
525	9.31E+04	4.66	7.5	8	41	1.00
526	1.09E+05	7.58	7.5	8	62	1.00
527	6.56E+04	3.27	7.5	2	50	1.00
528	5.38E+04	7.38	7.5	2	50	1.00
529	1.49E+05	7.80	17.5	4	95	1.00
530	1.46E+05	1.32	17.5	4	95	1.00
531	1.21E+05	2.38	17.5	12	95	1.00
532	1.62E+05	3.07	7.5	4	45	1.00
533	5.80E+04	2.47	22.5	4	92	1.00
534	1.52E+04	-999	22.5	4	92	1.00
535	2.29E+04	-999	12.5	5	24	1.00
536	2.02E+03	-999	12.5	4	52	1.00
537	9.15E+04	3.62	22.5	4	96	1.00
538	8.09E+04	-999	17.5	4	93	1.00
539	2.53E+04	6.55	12.5	13	40	1.00
540	8.09E+03	2.86	12.5	2	40	1.00
541	2.43E+04	0.83	12.5	12	39	1.00
542	2.38E+04	5.22	12.5	2	82	1.00
543	2.70E+04	-999	17.5	1	85	1.00
544	1.62E+04	2.86	7.5	2	31	1.00
545	4.86E+04	4.33	7.5	1	47	1.00
546	1.23E+05	2.68	17.5	4	89	1.00
547	2.02E+05	-999	12.5	4	51	1.00
548	4.05E+04	3.60	12.5	8	46	1.00
549	1.62E+05	6.14	22.5	12	91	1.00
550	1.25E+05	2.65	17.5	2	81	1.00
551	1.21E+05	2.21	17.5	4	93	1.00
552	2.02E+04	1.15	7.5	4	25	1.00
553	6.48E+04	4.06	7.5	2	50	1.00
554	4.33E+04	3.29	22.5	4	81	1.00
555	1.42E+05	3.04	17.5	4	80	1.00
556	6.07E+04	6.55	7.5	1	62	1.00
557	3.72E+05	-999	17.5	4	81	1.00
558	1.19E+06	2.61	7.5	2	50	1.00
559	6.07E+05	6.34	17.5	4	92	1.00
560	1.21E+05	3.14	12.5	4	52	1.00
561	3.64E+04	2.43	12.5	12	54	1.00
562	1.62E+05	1.23	12.5	8	32	1.00
563	2.02E+04	-999	7.5	1	31	1.00
564	6.48E+04	1.79	17.5	5	89	1.00

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
565	9.96E+04	1.93	17.5	5	81	1.00
566	5.06E+04	0.93	7.5	4	25	1.00
567	1.42E+05	1.17	17.5	4	81	1.00
568	8.09E+04	-999	7.5	2	48	1.00
569	2.02E+05	2.95	12.5	1	9	1.00
570	2.83E+05	5.84	7.5	1	44	1.00
571	2.02E+04	1.23	12.5	4	82	1.00
572	6.07E+05	1.85	17.5	5	81	1.00
573	1.98E+05	1.82	22.5	12	78	1.00
574	7.28E+05	2.73	17.5	1	85	1.00
575	6.68E+04	2.16	22.5	12	78	1.00
576	4.05E+05	0.52	12.5	4	74	1.00
577	1.35E+04	1.43	17.5	2	87	1.00
578	2.02E+05	0.82	7.5	2	50	1.00
579	5.67E+04	4.24	12.5	1	63	1.00
580	1.62E+05	2.86	12.5	13	24	1.00
581	2.83E+04	-999	17.5	1	95	1.00
582	1.23E+06	-999	17.5	2	80	1.00
583	1.62E+05	2.66	22.5	4	91	1.00
584	1.08E+04	-999	12.5	2	71	1.00
585	2.63E+04	2.97	7.5	4	50	1.00
586	1.92E+04	1.49	22.5	4	92	1.00
587	2.02E+05	1.38	12.5	8	32	1.00
588	3.97E+05	5.62	12.5	4	66	1.00
589	3.37E+04	-999	17.5	5	90	1.00
590	3.24E+04	5.16	17.5	4	93	1.00
591	1.34E+05	2.29	7.5	1	31	1.00
592	1.21E+05	2.86	12.5	13	40	1.00
593	1.66E+05	-999	22.5	12	78	1.00
594	5.67E+05	4.09	17.5	4	95	1.33
595	2.37E+04	1.58	17.5	5	90	1.33
596	6.07E+04	4.09	17.5	4	95	1.33
597	8.90E+04	2.10	17.5	5	90	1.33
598	4.86E+04	2.73	7.5	2	50	1.33
599	4.86E+04	4.48	12.5	1	69	1.33
600	3.31E+04	1.71	17.5	12	92	1.33
601	1.05E+06	0.90	7.5	13	48	1.33
602	1.42E+04	4.68	12.5	12	84	1.33
603	3.24E+05	4.09	7.5	8	32	1.33
604	9.31E+02	1.32	17.5	2	89	4.42
605	8.09E+03	-999	17.5	12	95	4.42
606	1.01E+04	0.65	12.5	2	4	4.42
607	1.38E+04	1.06	17.5	13	34	4.42
608	8.09E+03	-999	17.5	12	89	4.42
609	1.63E+05	-999	22.5	5	21	4.42
610	4.86E+02	0.71	12.5	5	40	4.42
611	7.08E+04	5.28	12.5	9	73	4.42

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
612	1.66E+03	2.59	22.5	12	58	4.42
613	4.05E+03	-999	7.5	4	60	4.42
614	4.05E+04	8.18	12.5	8	9	1.00
615	2.02E+03	7.39	12.5	4	40	1.00
616	1.78E+05	2.79	17.5	4	29	1.00
617	1.13E+04	2.57	12.5	1	9	1.00
618	4.05E+03	-999	17.5	12	89	1.00
619	7.49E+04	-999	17.5	2	89	1.00
620	9.66E+04	-999	22.5	4	58	1.00
621	5.67E+03	7.95	12.5	12	73	1.00
622	4.05E+04	-999	12.5	2	54	1.00
623	4.05E+04	-999	22.5	2	21	1.00
624	1.21E+05	-999	7.5	4	43	1.00
625	2.02E+04	0.82	12.5	1	8	1.00
626	1.01E+05	-999	12.5	5	26	1.00
627	4.45E+04	4.69	12.5	8	46	1.00
628	1.54E+04	4.55	12.5	8	42	1.00
629	5.36E+04	0.93	22.5	2	22	1.00
630	7.69E+04	1.63	17.5	12	89	1.00
631	4.05E+04	-999	17.5	1	95	1.00
632	1.36E+04	-999	17.5	2	87	1.00
633	1.62E+04	3.58	12.5	12	49	1.00
634	1.13E+04	2.59	12.5	8	9	1.00
635	1.62E+04	-999	17.5	4	93	1.00
636	8.09E+03	2.32	12.5	12	72	1.00
637	8.09E+03	-999	12.5	5	51	1.00
638	1.75E+04	-999	12.5	5	26	1.00
639	8.26E+04	-999	12.5	8	8	1.00
640	1.62E+04	5.11	7.5	4	25	1.00
641	8.50E+04	1.21	7.5	4	60	1.00
642	2.00E+04	-999	12.5	4	20	1.00
643	3.04E+05	0.91	22.5	4	58	1.00
644	2.02E+04	-999	17.5	1	95	1.00
645	1.21E+04	-999	12.5	12	54	1.00
646	1.30E+05	2.56	12.5	6	89	1.00
647	5.40E+04	6.14	22.5	12	91	1.00
648	9.61E+04	-999	22.5	4	58	1.00
649	7.89E+05	3.36	17.5	4	90	1.00
650	2.02E+05	3.27	12.5	2	52	1.36
651	1.06E+04	-999	12.5	12	71	1.36
652	2.43E+04	0.55	12.5	5	40	1.36
653	2.02E+03	-999	7.5	4	83	30.19
654	2.02E+03	-999	22.5	2	22	30.19
655	1.21E+05	-999	22.5	12	91	30.19
656	1.21E+02	0.68	17.5	4	36	30.19
657	1.82E+04	1.36	17.5	13	13	11.28
658	7.90E+04	3.88	22.5	12	91	11.28

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
659	1.42E+04	3.10	17.5	1	77	1.00
660	4.05E+04	2.05	12.5	7	29	1.00
661	1.00E+04	8.25	12.5	6	73	1.00
662	7.49E+02	0.92	17.5	4	23	1.00
663	5.26E+04	7.40	17.5	13	13	1.00
664	2.27E+05	7.31	12.5	6	73	1.00
665	2.63E+04	-999	12.5	1	5	1.00
666	5.46E+04	3.15	12.5	6	74	1.00
667	8.09E+03	-999	12.5	5	9	1.00
668	1.48E+04	1.67	17.5	4	89	1.00
669	4.98E+03	-999	17.5	5	90	1.00
670	6.48E+04	0.80	17.5	1	77	1.00
671	4.86E+03	-999	12.5	12	87	1.00
672	3.89E+05	1.49	22.5	4	96	1.00
673	3.64E+05	-999	7.5	2	32	1.37
674	2.43E+04	2.73	12.5	8	83	1.37
675	2.32E+04	-999	22.5	4	92	1.37
676	1.42E+05	-999	17.5	2	36	1.37
677	4.05E+04	4.09	22.5	12	93	1.37
678	6.07E+04	-999	12.5	2	39	24.00
679	9.11E+04	-999	12.5	13	24	24.00
680	2.79E+03	-999	17.5	12	85	1.89
681	9.31E+02	-999	17.5	5	13	1.89
682	2.95E+03	3.34	12.5	2	51	1.89
683	1.62E+05	0.87	17.5	12	85	1.89
684	4.65E+04	1.58	12.5	4	66	1.89
685	8.09E+03	-999	7.5	2	60	1.89
686	1.67E+04	3.47	12.5	12	87	1.00
687	1.42E+05	-999	22.5	12	76	1.00
688	3.52E+03	1.96	12.5	4	66	1.00
689	4.69E+03	1.59	12.5	5	3	1.00
690	2.19E+04	-999	17.5	4	20	1.00
691	1.01E+05	1.32	17.5	5	13	1.27
692	4.05E+03	-999	12.5	2	69	1.27
693	2.83E+04	0.88	22.5	4	96	1.00
694	1.66E+04	-999	12.5	12	69	1.00
695	4.05E+03	-999	22.5	12	92	1.00
696	9.41E+03	0.88	12.5	5	19	1.00
697	4.05E+03	1.06	22.5	4	81	1.00
698	2.27E+04	0.99	17.5	13	37	1.00
699	2.43E+03	2.94	22.5	4	58	1.00
700	1.38E+03	-999	22.5	4	35	1.00
701	2.02E+03	-999	17.5	4	81	1.00
702	8.34E+02	3.97	17.5	4	29	1.00
703	1.62E+04	0.99	22.5	4	96	1.00
704	2.02E+04	-999	12.5	5	27	1.00
705	8.36E+03	-999	7.5	4	7	1.00

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
706	2.43E+04	-999	17.5	5	34	1.00
707	4.05E+03	3.27	7.5	2	31	1.00
708	1.63E+04	3.38	22.5	4	92	1.00
709	7.28E+04	2.05	12.5	12	54	1.00
710	2.43E+04	1.32	12.5	8	46	1.00
711	4.18E+04	5.74	12.5	12	54	1.00
712	3.64E+04	2.05	22.5	4	92	1.00
713	4.05E+04	0.98	12.5	4	74	1.00
714	3.04E+04	-999	12.5	8	46	1.00
715	3.04E+05	-999	22.5	4	96	1.00
716	1.62E+04	0.85	17.5	4	23	1.00
717	3.84E+04	-999	17.5	4	80	1.00
718	2.02E+03	1.33	17.5	4	29	1.00
719	2.36E+04	1.18	17.5	13	29	1.00
720	6.21E+02	-999	12.5	2	19	1.00
721	1.01E+05	5.73	12.5	12	73	1.00
722	1.62E+04	-999	17.5	4	95	1.00
723	8.09E+04	-999	17.5	4	20	1.00
724	1.42E+04	1.04	12.5	5	26	1.00
725	4.05E+04	-999	17.5	4	93	1.17
726	4.05E+03	2.05	12.5	2	39	1.17
727	4.65E+04	-999	12.5	5	40	1.17
728	3.24E+02	-999	12.5	2	52	1.17
729	8.09E+03	-999	17.5	4	95	1.17
730	1.52E+05	3.27	7.5	13	68	10.23
731	5.67E+04	2.63	17.5	2	30	10.23
732	2.48E+03	-999	7.5	1	47	10.23
733	1.11E+04	-999	12.5	2	50	1.00
734	2.43E+04	1.91	12.5	2	71	1.00
735	1.66E+05	7.98	12.5	8	32	1.00
736	1.02E+06	0.65	12.5	5	51	1.00
737	1.36E+05	-999	12.5	5	34	1.00
738	1.21E+04	1.09	17.5	1	95	1.00
739	8.09E+04	-999	12.5	12	42	1.00
740	3.10E+04	0.94	12.5	2	52	1.00
741	1.62E+04	-999	7.5	8	32	1.00
742	1.62E+04	-999	17.5	2	90	1.36
743	2.02E+05	1.74	17.5	5	13	1.36
744	1.01E+05	-999	17.5	5	23	1.36
745	1.82E+04	2.83	12.5	5	74	1.36
746	6.07E+02	-999	22.5	2	36	1.36
747	1.82E+04	3.00	17.5	4	93	1.36
748	1.78E+04	0.83	12.5	2	39	1.36
749	4.05E+04	2.36	7.5	4	60	1.36
750	7.90E+04	-999	7.5	12	42	1.36
751	3.34E+04	4.46	12.5	9	74	1.36
752	3.04E+04	2.02	22.5	4	96	1.36

Table D.1 Nationwide Database of Landfill Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
753	4.05E+03	-999	12.5	2	54	1.36
754	3.72E+03	-999	12.5	12	49	1.36
755	2.43E+04	2.14	12.5	2	74	1.36
756	2.31E+05	-999	7.5	2	32	1.00
757	1.86E+04	0.79	17.5	12	89	1.00
758	1.62E+04	1.32	12.5	12	69	1.00
759	1.82E+04	-999	12.5	13	40	1.00
760	8.09E+04	0.53	22.5	4	96	1.00
761	5.26E+04	-999	22.5	4	96	1.00
762	4.25E+04	-999	22.5	4	96	1.00
763	7.69E+03	1.08	12.5	5	51	1.00
764	1.62E+04	2.86	12.5	2	39	1.00
765	5.67E+04	4.38	22.5	12	91	1.00
766	2.63E+05	0.76	22.5	4	96	1.00
767	8.09E+03	1.02	17.5	1	77	1.00
768	3.64E+04	-999	17.5	4	93	1.00
769	5.95E+04	2.27	17.5	2	93	1.00
770	2.32E+04	1.28	17.5	4	80	1.00
771	1.58E+05	-999	12.5	4	72	1.00
772	2.83E+04	-999	17.5	4	80	1.00
773	8.50E+04	2.92	22.5	2	36	1.00
774	1.21E+05	-999	17.5	4	89	6.82
775	2.43E+05	-999	17.5	4	93	6.82
776	1.82E+04	1.24	17.5	1	85	1.00
777	1.62E+04	2.05	12.5	12	69	1.00
778	1.27E+04	3.34	17.5	1	79	1.00
779	6.07E+03	-999	17.5	1	85	1.00
780	4.29E+04	1.48	17.5	12	85	1.00
781	1.52E+05	1.82	17.5	1	85	1.00
782	1.01E+04	3.14	17.5	1	95	1.00
783	7.97E+03	-999	17.5	4	93	1.00
784	8.09E+03	-999	17.5	4	79	1.00
785	8.09E+03	-999	17.5	1	79	1.00
786	2.43E+05	-999	17.5	12	95	1.00
787	8.09E+03	0.82	7.5	1	31	3.09
788	1.34E+03	1.98	7.5	4	84	3.09
789	6.48E+04	1.84	7.5	8	44	1.00
790	1.21E+04	-999	7.5	8	62	1.36

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
1	6.31E+02	2.13	0.00	0.2	12.5	110	50	1	6	4	7.02
2	9.39E+03	1.22	0.00	0.2	17.5	5000	50	1	5	12	25.16
3	9.75E+03	2.44	0.00	0.2	17.5	5000	50	1	5	12	25.16
4	2.20E+04	2.44	0.00	0.2	17.5	5000	50	1	5	12	25.16
5	2.93E+04	3.54	5.98	0.2	17.5	5000	50	1	5	12	25.16
6	8.83E+02	0.61	1.22	0.2	12.5	120	50	2	10	72	22.33
7	5.81E+03	0.61	1.22	0.2	12.5	110	50	2	10	72	22.33
8	1.68E+03	6.25	7.32	0.2	12.5	900	7	3	2	56	29.82
9	2.59E+05	0.76	1.52	0.2	17.5	1450	22	1	1	85	7.21
10	3.60E+05	10.97	9.30	0.2	17.5	100	42	3	1	77	6.81
11	6.56E+04	6.10	8.53	0.2	17.5	625	50	3	1	77	6.81
12	4.05E+05	5.33	14.48	0.2	17.5	75	50	3	1	77	6.81
13	1.25E+05	8.53	2.29	0.2	17.5	960	50	3	1	77	6.81
14	3.24E+05	5.33	12.04	0.2	17.5	125	50	3	1	77	6.81
15	6.60E+04	8.84	9.60	0.2	17.5	775	50	3	1	77	6.81
16	2.59E+05	6.10	7.32	0.2	17.5	350	50	3	1	77	6.81
17	2.93E+03	-999	0.00	0.2	17.5	150	50	3	10	80	123.12
18	2.69E+03	3.66	4.57	0.2	17.5	1600	50	3	10	91	238.79
19	1.67E+04	3.66	4.57	0.2	17.5	1600	50	3	10	91	238.79
20	2.69E+03	3.66	4.57	0.2	17.5	1600	50	3	10	91	238.79
21	5.40E+02	-999	0.00	0.2	12.5	5000	41	2	8	42	21.14
22	4.05E+03	3.66	4.57	0.2	17.5	5000	23	3	1	77	3.61
23	1.17E+04	3.20	3.81	0.2	17.5	5000	50	3	1	77	3.61
24	4.05E+03	3.66	6.10	0.2	17.5	5000	23	3	1	77	3.61
25	3.72E+04	1.68	8.23	0.2	17.5	5000	50	3	1	77	3.61
26	2.42E+03	1.25	3.94	0.2	22.5	20	24	3	10	96	21.82
27	3.07E+03	1.83	2.19	0.2	22.5	55	22	3	10	96	21.82

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
28	7.66E+02	2.29	2.29	0.2	22.5	5000	47	1	10	81	25.05
29	1.52E+02	0.76	1.37	0.2	22.5	5000	17	1	10	81	25.05
30	5.81E+02	1.83	0.00	0.2	17.5	190	50	1	6	34	28.76
31	2.32E+03	1.52	2.44	0.2	12.5	115	50	1	2	42	117.25
32	7.90E+03	0.61	1.52	0.2	12.5	40	27	3	2	42	117.25
33	1.62E+04	3.51	1.95	0.2	22.5	5000	50	3	10	96	1.01
34	1.62E+04	3.51	1.95	0.2	22.5	5000	50	3	10	96	1.01
35	1.21E+04	4.27	1.37	0.2	17.5	410	50	3	6	54	1.70
36	4.80E+05	4.80	1.30	0.2	17.5	90	50	3	6	54	1.70
37	1.21E+05	6.10	1.68	0.2	17.5	50	50	3	6	54	1.70
38	1.49E+05	4.57	0.00	0.2	17.5	65	50	3	6	54	1.70
39	7.69E+03	4.27	0.46	0.2	17.5	65	50	3	6	54	1.70
40	1.02E+05	4.57	2.59	0.2	17.5	65	50	3	6	54	1.70
41	2.00E+03	1.07	0.61	0.2	7.5	120	50	1	7	66	7.21
42	2.58E+03	2.44	1.07	0.2	7.5	130	50	1	7	66	7.21
43	2.58E+03	2.44	1.07	0.2	7.5	145	50	1	7	66	7.21
44	2.53E+03	2.74	1.07	0.2	7.5	145	50	1	7	66	7.21
45	1.21E+05	3.12	0.00	0.2	17.5	85	50	1	7	91	1.01
46	2.75E+05	-999	0.00	0.2	17.5	300	50	1	7	91	1.01
47	1.11E+06	0.34	0.00	0.2	17.5	85	50	1	7	91	1.01
48	3.54E+02	-999	0.00	0.2	12.5	20	50	1	2	71	7.02
49	4.87E+02	0.68	0.00	0.2	12.5	20	50	1	2	71	7.02
50	6.07E+03	4.18	3.87	0.2	12.5	695	50	3	9	49	23.04
51	1.42E+04	1.52	0.00	0.2	12.5	330	50	3	9	49	23.04

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
52	6.07E+03	4.18	3.87	0.2	12.5	710	50	3	9	49	23.04
53	1.42E+04	3.66	1.83	0.2	12.5	620	50	3	9	49	23.04
54	1.35E+03	3.66	1.83	0.2	12.5	575	50	3	9	49	23.04
55	1.35E+03	3.66	1.83	0.2	12.5	590	50	3	9	49	23.04
56	2.02E+04	4.13	3.61	0.2	12.5	530	50	3	9	49	23.04
57	6.06E+03	1.52	0.40	0.2	7.5	20	50	2	6	25	7.67
58	6.04E+03	1.63	0.38	0.2	7.5	60	50	2	6	25	7.67
59	4.05E+05	2.43	0.00	0.2	12.5	25	50	3	7	54	7.02
60	1.01E+06	2.58	0.00	0.2	12.5	25	50	3	7	54	7.02
61	1.62E+03	2.28	0.00	0.2	12.5	5000	57	3	7	54	7.02
62	2.02E+02	2.74	0.00	0.2	12.5	5000	50	3	7	54	7.02
63	6.97E+02	2.28	5.72	0.2	12.5	20	50	1	2	39	21.25
64	1.04E+03	0.03	0.52	0.2	22.5	1520	50	2	4	78	26.72
65	1.49E+03	1.22	1.83	0.2	12.5	20	31	3	12	6	23.20
66	1.39E+02	0.30	1.98	0.2	12.5	20	50	3	12	6	23.20
67	1.23E+03	1.47	0.00	0.2	12.5	90	5	3	12	6	23.20
68	2.79E+01	0.61	0.00	0.2	12.5	140	50	3	12	6	23.20
69	5.06E+04	1.49	3.63	0.2	17.5	1200	50	1	10	93	7.27
70	1.62E+03	0.46	2.74	0.2	17.5	1100	55	1	10	93	7.27
71	1.62E+03	1.74	0.61	0.2	17.5	750	55	1	10	93	7.27
72	4.86E+03	0.46	6.10	0.2	17.5	930	65	1	10	93	7.27
73	4.86E+03	-999	4.45	0.2	17.5	1600	65	1	10	93	7.27
74	1.82E+04	1.07	3.51	0.2	17.5	1700	65	1	10	93	7.27

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
75	4.05E+03	1.98	2.59	0.2	17.5	5000	50	1	10	93	7.27
76	1.86E+03	-999	0.00	0.2	17.5	5000	5	1	10	93	7.27
77	6.99E+03	1.31	2.23	0.2	17.5	700	50	1	10	93	7.27
78	9.68E+03	1.07	8.08	0.2	17.5	1100	50	1	10	93	7.27
79	5.26E+04	3.89	2.44	0.2	17.5	5000	36	1	10	93	7.27
80	4.45E+04	4.43	1.83	0.2	17.5	1900	35	1	10	93	7.27
81	9.31E+03	1.37	2.44	0.2	17.5	700	65	1	10	93	7.27
82	5.30E+03	2.18	0.91	0.2	7.5	5000	16	3	4	48	7.67
83	5.23E+03	4.57	2.74	0.2	7.5	5000	50	3	4	48	7.67
84	4.46E+03	3.05	1.22	0.2	7.5	5000	50	3	4	48	7.67
85	3.57E+03	0.61	1.52	0.2	7.5	5000	50	3	4	48	7.67
86	8.88E+03	4.27	2.74	0.2	7.5	5000	50	3	4	48	7.67
87	8.76E+03	3.05	3.05	0.2	7.5	5000	50	3	4	48	7.67
88	4.06E+03	2.13	1.52	0.2	7.5	5000	50	3	4	48	7.67
89	1.74E+05	4.55	3.51	0.2	22.5	200	50	3	6	96	6.81
90	1.29E+05	2.26	1.07	0.2	22.5	50	50	3	6	96	6.81
91	1.86E+04	3.35	4.27	0.2	17.5	255	32	3	7	90	7.21
92	1.53E+03	1.37	2.90	0.2	17.5	180	27	3	7	90	7.21
93	2.63E+05	0.30	1.07	0.2	17.5	1220	50	3	10	89	6.81
94	1.94E+04	3.05	3.66	0.2	17.5	5000	50	3	10	89	6.81
95	1.62E+04	4.05	5.18	0.2	17.5	5000	50	3	10	89	6.81
96	3.48E+04	3.05	3.66	0.2	17.5	5000	50	3	10	89	6.81
97	1.21E+03	3.12	3.66	0.2	17.5	5000	50	3	10	89	6.81

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
98	1.21E+03	5.49	3.05	0.2	17.5	0	50	1	10	89	6.81
99	8.58E+05	1.52	1.52	0.2	17.5	1550	50	3	10	89	6.81
100	6.11E+04	4.57	5.94	0.2	17.5	1020	50	3	10	89	6.81
101	2.67E+04	3.05	0.30	0.2	17.5	1380	50	3	10	89	6.81
102	6.07E+04	5.11	4.88	0.2	17.5	1900	50	3	10	89	6.81
103	1.01E+04	4.49	5.18	0.2	17.5	5000	50	3	10	89	6.81
104	6.14E+04	1.83	3.05	0.2	17.5	1620	50	3	10	89	6.81
105	1.54E+05	4.57	1.83	0.2	17.5	1100	50	3	10	89	6.81
106	6.19E+04	5.44	6.48	0.2	17.5	1960	50	3	10	89	6.81
107	8.09E+04	-999	1.07	0.2	17.5	240	50	1	10	81	21.82
108	2.30E+02	3.35	3.05	0.2	12.5	180	27	1	6	39	23.20
109	2.09E+03	1.53	0.00	0.2	12.5	800	50	2	2	71	29.06
110	2.02E+05	2.29	2.90	0.2	17.5	140	50	1	10	93	3.40
111	8.09E+03	2.44	3.05	0.2	17.5	975	50	1	10	93	3.40
112	8.09E+03	2.74	2.13	0.2	17.5	895	50	1	10	93	3.40
113	4.86E+04	2.74	3.66	0.2	17.5	910	50	1	10	93	3.40
114	8.09E+03	2.44	3.35	0.2	17.5	950	50	1	10	93	3.40
115	2.31E+04	3.05	3.96	0.2	17.5	845	50	1	10	93	3.40
116	2.02E+05	5.18	5.49	0.2	17.5	25	50	1	10	93	3.40
117	6.48E+03	4.85	0.00	0.2	17.5	360	50	1	10	93	3.40
118	1.70E+05	4.57	6.71	0.2	17.5	500	50	1	10	93	3.40
119	1.01E+03	2.44	2.74	0.2	17.5	270	50	1	10	93	3.40
120	2.43E+04	4.57	4.88	0.2	17.5	820	50	1	10	93	3.40

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
121	1.39E+03	3.05	3.12	0.2	12.5	180	50	3	6	6	7.21
122	1.39E+03	4.57	5.49	0.2	12.5	230	50	3	6	6	7.21
123	5.57E+03	4.57	5.49	0.2	12.5	265	50	3	6	6	7.21
124	5.57E+02	3.81	4.66	0.2	12.5	230	50	3	6	6	7.21
125	4.06E+03	3.68	4.66	0.2	12.5	270	50	3	6	6	7.21
126	2.83E+04	-999	1.52	0.2	12.5	180	50	1	4	46	7.67
127	1.01E+04	0.30	6.10	0.2	12.5	605	50	1	4	46	7.67
128	1.42E+04	0.30	3.20	0.2	12.5	590	50	1	4	46	7.67
129	8.09E+03	3.35	1.98	0.2	12.5	320	50	1	4	46	7.67
130	2.02E+04	0.91	3.96	0.2	12.5	180	50	1	4	46	7.67
131	2.83E+03	1.73	3.35	0.2	12.5	330	50	1	4	46	7.67
132	7.43E+01	1.52	2.44	0.2	12.5	1800	13	3	2	69	21.54
133	2.86E+05	1.22	0.00	0.2	22.5	150	50	2	10	92	6.81
134	1.30E+05	1.67	0.00	0.2	22.5	280	52	1	10	96	21.43
135	7.49E+04	1.98	0.30	0.2	7.5	30	60	2	8	42	3.61
136	5.26E+03	1.60	2.44	0.2	7.5	290	60	2	8	42	3.61
137	4.73E+04	0.76	1.83	0.2	7.5	30	60	2	8	42	3.61
138	7.49E+04	2.74	0.00	0.2	7.5	30	60	2	8	42	3.61
139	3.68E+04	1.37	1.83	0.2	7.5	30	60	2	8	42	3.61
140	5.02E+02	1.07	0.00	0.2	17.5	455	30	1	5	13	21.25
141	1.19E+04	1.45	1.22	0.2	17.5	160	50	1	2	90	6.81
142	1.39E+03	1.22	2.74	0.2	17.5	340	50	3	2	90	6.81
143	4.61E+03	0.15	1.83	0.2	17.5	950	50	3	2	90	6.81

Table D.2 Nationwide Database of Surface Impoundment Sites

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144	8.71E+02	1.52	2.44	0.2	17.5	560	50	3	2	90	6.81
145	5.96E+04	4.57	5.49	0.2	17.5	470	50	3	2	90	6.81
146	1.33E+03	1.52	5.49	0.2	17.5	480	50	3	2	90	6.81
147	3.43E+03	1.52	3.51	0.2	17.5	600	50	3	2	90	6.81
148	1.45E+05	2.29	2.29	0.2	17.5	100	50	3	2	90	6.81
149	6.01E+03	1.52	3.66	0.2	17.5	700	50	1	2	90	6.81
150	5.30E+02	1.22	1.22	0.2	7.5	110	20	2	9	49	20.59
151	1.30E+02	1.22	1.22	0.2	7.5	20	27	2	9	49	20.59
152	7.80E+02	1.22	1.22	0.2	7.5	110	20	2	9	49	20.59
153	7.80E+02	1.22	1.22	0.2	7.5	110	20	2	9	49	20.59
154	9.14E+02	-999	0.30	0.2	12.5	20	15	2	8	59	7.02
155	2.93E+03	1.52	2.44	0.2	17.5	1300	50	3	2	37	19.70
156	2.69E+03	1.52	2.44	0.2	17.5	1330	50	3	2	37	19.70
157	1.99E+03	-999	1.52	0.2	17.5	1480	17	3	2	37	19.70
158	2.28E+03	-999	1.52	0.2	17.5	1455	17	3	2	37	19.70
159	1.36E+03	1.68	1.68	0.2	17.5	1450	50	3	12	89	7.39
160	8.38E+03	4.57	6.10	0.2	17.5	1180	50	3	12	89	7.39
161	3.48E+03	2.29	4.42	0.2	17.5	5000	50	3	12	89	7.39
162	8.09E+05	3.05	0.00	0.2	22.5	1500	50	3	6	81	6.81
163	2.38E+01	4.57	4.88	0.2	22.5	1575	4	1	7	81	23.36
164	1.38E+03	4.57	3.05	0.2	22.5	1270	50	3	10	96	3.61
165	1.39E+03	0.61	3.66	0.2	22.5	1340	50	3	10	96	3.61
166	2.06E+02	0.76	1.37	0.2	17.5	95	50	3	10	80	26.72

Table D.2 Nationwide Database of Surface Impoundment Sites

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167	5.26E+02	0.64	0.00	0.2	17.5	20	65	1	2	15	1.01
168	2.02E+03	2.44	3.05	0.2	17.5	20	65	3	2	15	1.01
169	2.63E+04	-999	4.42	0.2	22.5	215	50	3	10	96	7.67
170	6.07E+03	0.58	1.22	0.2	22.5	1645	50	3	10	96	7.67
171	7.08E+05	1.22	2.44	0.2	22.5	35	50	3	10	96	7.67
172	2.83E+05	0.91	1.83	0.2	22.5	35	50	3	10	96	7.67
173	4.25E+05	1.37	2.29	0.2	22.5	35	50	3	10	96	7.67
174	3.64E+04	2.44	3.05	0.2	22.5	20	50	3	10	96	7.67
175	1.50E+04	1.98	0.30	0.2	22.5	1440	50	3	10	96	7.67
176	1.13E+04	-999	0.00	0.2	17.5	20	47	1	1	85	11.83
177	1.13E+04	-999	0.00	0.2	17.5	30	47	1	1	85	11.83
178	5.55E+03	-999	2.13	0.2	17.5	1800	50	1	2	6	11.52
179	3.33E+03	-999	1.98	0.2	17.5	2000	50	1	2	6	11.52
180	5.14E+05	2.74	3.96	0.2	17.5	5000	50	3	6	90	6.81
181	5.06E+03	1.37	2.13	0.2	17.5	5000	50	3	6	90	6.81
182	7.28E+03	0.84	2.06	0.2	17.5	1500	50	3	6	90	6.81
183	4.05E+05	1.14	4.50	0.2	17.5	5000	50	3	6	90	6.81
184	6.07E+04	1.70	4.11	0.2	17.5	5000	22	3	6	90	6.81
185	1.21E+04	4.11	5.18	0.2	17.5	5000	50	3	6	90	6.81
186	1.21E+04	5.26	6.02	0.2	17.5	5000	50	3	6	90	6.81
187	2.14E+05	3.21	3.96	0.2	17.5	475	47	3	6	90	6.81
188	1.21E+04	5.49	6.10	0.2	12.5	60	50	1	4	46	6.81
189	2.43E+05	4.57	5.18	0.2	12.5	40	50	1	4	46	6.81

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
190	4.05E+04	3.51	0.00	0.2	12.5	90	50	2	5	82	6.81
191	6.27E+04	5.05	9.51	0.2	22.5	150	50	2	4	76	7.21
192	3.04E+04	-999	4.72	0.2	22.5	330	16	2	4	76	7.21
193	2.67E+04	-999	5.64	0.2	22.5	315	16	2	4	76	7.21
194	9.29E+03	1.37	3.96	0.2	22.5	1700	24	3	10	92	23.20
195	1.45E+03	2.26	2.44	0.2	22.5	1600	50	3	10	92	23.20
196	5.38E+03	2.77	3.66	0.2	22.5	1260	50	3	10	92	23.20
197	5.38E+03	2.77	3.96	0.2	22.5	1140	50	3	10	92	23.20
198	8.99E+02	1.83	3.66	0.2	22.5	1080	50	3	10	92	23.20
199	8.99E+02	1.83	3.66	0.2	22.5	1080	50	3	10	92	23.20
200	1.19E+03	3.66	5.03	0.2	17.5	395	50	1	10	79	7.21
201	6.07E+03	1.37	2.29	0.2	17.5	130	50	1	10	79	7.21
202	2.20E+03	3.96	4.72	0.2	17.5	395	50	1	10	79	7.21
203	1.19E+03	3.66	5.03	0.2	17.5	395	50	1	10	79	7.21
204	8.36E+03	1.52	3.35	0.2	17.5	500	50	1	10	79	7.21
205	4.49E+04	1.22	1.07	0.2	17.5	550	50	1	10	79	7.21
206	1.41E+03	3.49	3.89	0.2	17.5	480	50	1	10	79	7.21
207	3.18E+03	3.57	3.96	0.2	17.5	480	50	1	10	79	7.21
208	1.76E+03	1.68	1.72	0.2	17.5	660	50	1	10	79	7.21
209	1.19E+03	3.66	5.03	0.2	17.5	395	50	1	10	79	7.21
210	4.41E+03	2.16	0.61	0.2	12.5	850	65	3	2	73	21.82
211	1.30E+04	1.71	1.92	0.2	12.5	695	8	3	2	73	21.82
212	8.82E+03	0.30	0.30	0.2	22.5	150	50	2	11	94	26.72

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
213	8.76E+03	0.30	0.30	0.2	22.5	90	50	2	11	94	26.72
214	2.02E+05	3.66	2.13	0.2	17.5	335	50	2	10	80	3.40
215	1.21E+03	1.83	3.66	0.2	17.5	600	30	2	10	80	3.40
216	2.02E+03	-999	0.00	0.2	17.5	65	50	1	10	80	3.40
217	4.69E+05	2.97	2.67	0.2	17.5	115	50	1	10	80	3.40
218	2.02E+05	3.66	2.13	0.2	17.5	435	50	2	10	80	3.40
219	1.55E+03	1.10	2.74	0.2	12.5	270	50	2	7	66	117.25
220	2.68E+03	2.13	1.83	0.2	12.5	270	50	2	7	66	117.25
221	2.21E+03	3.05	3.66	0.2	27.5	1800	50	3	6	102	7.67
222	3.19E+03	2.13	0.00	0.2	27.5	656	50	3	6	102	7.67
223	1.90E+03	3.05	3.66	0.2	27.5	1800	50	3	6	102	7.67
224	1.90E+03	3.05	3.66	0.2	27.5	1800	50	3	6	102	7.67
225	3.24E+04	1.37	0.15	0.2	7.5	850	50	3	9	62	6.81
226	3.24E+04	1.98	0.61	0.2	7.5	755	50	2	9	62	6.81
227	3.16E+04	5.33	2.13	0.2	7.5	320	50	2	9	62	6.81
228	2.79E+03	3.96	5.79	0.2	17.5	320	50	3	12	89	21.25
229	2.87E+04	1.37	2.74	0.2	17.5	1580	50	1	12	89	21.25
230	5.04E+03	3.66	0.00	0.2	17.5	1500	50	1	12	89	21.25
231	5.04E+03	3.66	0.00	0.2	17.5	1560	50	1	12	89	21.25
232	2.18E+04	1.68	3.05	0.2	17.5	1750	50	1	12	89	21.25
233	9.29E+02	1.83	0.91	0.2	22.5	505	18	3	10	92	7.67
234	2.37E+04	1.83	1.22	0.2	22.5	505	50	3	10	92	7.67
235	2.42E+03	1.68	2.35	0.2	17.5	350	50	1	2	15	23.20

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
236	2.98E+04	0.88	3.26	0.2	17.5	400	50	1	2	15	23.20
237	2.83E+03	1.89	2.26	0.2	17.5	350	50	1	2	15	23.20
238	3.12E+04	2.07	2.83	0.2	17.5	350	50	1	2	15	23.20
239	6.07E+03	0.81	0.00	0.2	17.5	580	57	1	2	15	23.20
240	4.86E+03	1.01	0.00	0.2	17.5	580	55	1	2	15	23.20
241	6.48E+03	1.11	0.00	0.2	17.5	580	55	1	2	15	23.20
242	1.07E+04	2.06	2.06	0.2	17.5	350	50	1	2	15	23.20
243	2.36E+03	1.86	2.53	0.2	17.5	350	50	1	2	15	23.20
244	1.62E+04	3.81	4.57	0.2	12.5	200	50	1	1	69	26.72
245	3.12E+01	1.22	0.00	0.2	12.5	30	12	2	4	46	26.72
246	5.20E+01	0.24	0.28	0.2	22.5	5000	7	2	4	57	63.12
247	1.42E+03	3.45	5.18	0.2	12.5	30	50	3	9	39	21.25
248	1.21E+04	1.22	1.98	0.2	7.5	75	50	2	4	42	3.40
249	1.21E+04	0.30	0.91	0.2	7.5	25	50	2	4	42	3.40
250	1.80E+05	-999	0.00	0.2	22.5	95	50	1	10	91	6.81
251	6.61E+03	5.64	0.00	0.2	22.5	720	50	2	10	91	6.81
252	7.93E+04	3.05	3.81	0.2	22.5	565	50	1	10	91	6.81
253	4.82E+05	1.22	2.29	0.2	22.5	670	50	2	10	91	6.81
254	1.92E+04	3.05	4.27	0.2	22.5	40	50	2	10	91	6.81
255	1.92E+04	3.05	4.27	0.2	22.5	40	50	2	10	91	6.81
256	5.67E+03	0.15	1.68	0.2	22.5	5000	37	3	10	96	7.21
257	5.67E+03	0.38	1.91	0.2	22.5	5000	37	3	10	96	7.21
258	1.37E+04	-999	0.00	0.2	22.5	60	50	3	10	96	1.01

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
259	1.86E+05	0.63	0.00	0.2	22.5	250	95	3	10	96	1.01
260	2.16E+05	-999	0.00	0.2	22.5	85	50	3	10	96	1.01
261	1.57E+05	-999	0.00	0.2	22.5	385	50	3	10	96	1.01
262	1.12E+05	-999	0.00	0.2	22.5	700	50	3	10	96	1.01
263	1.09E+05	2.11	0.00	0.2	22.5	710	75	3	10	96	1.01
264	1.70E+05	-999	0.00	0.2	22.5	240	50	3	10	96	1.01
265	4.74E+02	2.13	4.57	0.2	17.5	180	50	3	10	93	7.21
266	2.01E+03	1.83	3.05	0.2	22.5	5000	50	3	10	58	7.39
267	2.01E+03	1.83	3.05	0.2	22.5	5000	50	3	10	58	7.39
268	4.01E+02	-999	0.00	0.2	17.5	360	50	3	2	34	229.99
269	9.17E+01	-999	0.00	0.2	17.5	360	50	3	2	34	229.99
270	2.60E+01	-999	0.00	0.2	17.5	360	50	3	2	34	229.99
271	4.01E+02	-999	0.00	0.2	17.5	360	50	3	2	34	229.99
272	4.01E+02	-999	0.00	0.2	17.5	360	50	3	2	34	229.99
273	3.52E+04	2.05	2.90	0.2	12.5	400	50	3	5	24	117.97
274	4.05E+03	2.12	3.58	0.2	12.5	350	50	3	5	24	117.97
275	1.62E+04	4.39	6.16	0.2	17.5	5000	50	2	5	20	7.02
276	1.78E+04	0.91	1.83	0.2	17.5	5000	27	2	5	20	7.02
277	3.67E+03	3.05	1.52	0.2	7.5	140	37	1	6	25	7.67
278	4.30E+03	4.21	7.92	0.2	12.5	1260	47	1	12	73	21.25
279	6.31E+03	2.50	5.79	0.2	12.5	1260	50	1	12	73	21.25
280	2.02E+04	-999	0.00	0.2	12.5	1260	50	1	12	73	21.25
281	9.30E+00	1.83	3.05	0.2	12.5	130	14	2	8	61	21.25

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Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
282	5.89E+04	3.35	4.57	0.2	12.5	310	50	3	6	6	7.21
283	5.65E+04	3.35	4.57	0.2	12.5	110	47	3	6	6	7.21
284	1.69E+04	4.27	0.00	0.2	7.5	1480	50	1	9	44	38.99
285	4.58E+04	1.83	3.66	0.2	7.5	1620	50	1	9	44	38.99
286	1.17E+04	1.98	3.66	0.2	7.5	190	50	1	9	44	38.99
287	2.02E+03	-999	1.07	0.2	7.5	190	50	1	9	44	38.99
288	6.07E+03	-999	1.07	0.2	7.5	180	65	1	9	44	38.99
289	1.68E+05	6.25	5.33	0.2	7.5	1360	50	1	9	44	38.99
290	2.84E+03	1.37	1.83	0.2	7.5	20	50	1	9	44	38.99
291	7.53E+02	0.93	0.00	0.2	7.5	20	50	1	9	44	38.99
292	1.33E+05	4.27	3.35	0.2	7.5	1040	50	1	9	44	38.99
293	6.97E+03	2.39	0.00	0.2	17.5	1220	50	3	6	90	7.86
294	4.46E+03	3.84	5.18	0.2	17.5	1510	50	3	6	90	7.86
295	1.34E+04	3.20	0.00	0.2	12.5	220	50	2	7	66	10.30
296	3.67E+02	1.42	0.61	0.2	12.5	50	50	2	4	86	29.82
297	2.47E+04	3.83	3.81	0.2	7.5	240	50	2	9	44	6.81
298	8.63E+04	5.48	3.35	0.2	7.5	130	50	2	9	44	6.81
299	1.01E+03	3.25	2.97	0.2	7.5	40	50	2	9	43	7.02
300	7.28E+04	0.50	1.46	0.2	7.5	5000	30	3	9	43	7.02
301	5.26E+04	1.29	2.74	0.2	7.5	5000	50	3	9	43	7.02
302	5.34E+03	0.91	4.27	0.2	7.5	455	50	3	9	43	7.02
303	8.90E+03	5.49	3.35	0.2	17.5	710	18	1	10	81	6.81
304	5.50E+03	3.44	0.00	0.2	17.5	950	50	1	10	81	6.81

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
305	3.69E+03	4.65	4.53	0.2	17.5	1100	50	1	10	81	6.81
306	2.79E+05	1.22	0.00	0.2	17.5	905	22	3	10	81	6.81
307	2.47E+05	3.05	2.13	0.2	17.5	1100	50	1	10	81	6.81
308	4.86E+06	2.44	0.00	0.2	17.5	125	50	3	10	81	6.81
309	3.64E+04	1.52	0.61	0.2	17.5	720	50	1	10	81	6.81
310	9.71E+03	2.74	0.00	0.2	17.5	1500	50	1	10	81	6.81
311	1.21E+04	1.01	0.79	0.2	17.5	950	50	1	10	81	6.81
312	2.47E+05	4.57	0.46	0.2	17.5	1540	50	3	10	81	6.81
313	1.76E+03	1.83	0.00	0.2	7.5	460	50	1	4	100	36.31
314	3.59E+03	1.22	0.00	0.2	7.5	480	50	1	4	100	36.31
315	3.26E+03	1.68	0.76	0.2	7.5	500	50	1	4	100	36.31
316	3.52E+03	-999	0.91	0.2	7.5	60	22	3	7	10	7.67
317	5.07E+02	2.44	2.44	0.2	7.5	75	50	3	7	10	7.67
318	1.00E+03	-999	2.44	0.2	7.5	20	22	3	7	10	7.67
319	1.28E+03	-999	2.04	0.2	7.5	20	22	3	7	10	7.67
320	1.17E+05	2.74	3.66	0.2	7.5	5000	50	3	7	10	7.67
321	1.32E+03	2.08	1.99	0.2	7.5	75	50	3	7	10	7.67
322	1.11E+03	1.27	0.61	0.2	17.5	90	24	3	2	89	7.27
323	9.96E+02	5.49	6.10	0.2	17.5	190	47	2	5	12	7.21
324	1.23E+03	0.91	1.22	0.2	17.5	5000	50	1	2	95	23.04
325	8.36E+01	-999	6.10	0.2	17.5	5000	50	1	2	95	23.04
326	9.29E+01	-999	6.10	0.2	17.5	5000	50	1	2	95	23.04
327	1.24E+03	0.91	1.22	0.2	17.5	5000	50	1	2	95	23.04

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
328	7.43E+02	-999	1.07	0.2	22.5	150	50	3	6	96	3.61
329	1.23E+03	3.35	3.96	0.2	22.5	340	50	3	10	96	3.61
330	1.24E+03	-999	1.98	0.2	22.5	120	50	3	6	96	3.61
331	2.92E+03	4.27	2.44	0.2	22.5	90	7	3	10	96	3.61
332	2.92E+03	4.27	2.44	0.2	22.5	90	7	3	10	96	3.61
333	5.34E+02	0.19	1.22	0.2	22.5	1330	50	3	6	96	3.61
334	2.42E+03	1.22	2.90	0.2	22.5	130	17	3	10	96	3.61
335	1.67E+03	0.30	1.22	0.2	22.5	190	17	3	10	96	3.61
336	2.92E+03	4.27	2.44	0.2	22.5	20	7	3	10	96	3.61
337	2.79E+04	13.72	33.53	0.2	12.5	1315	50	3	6	51	21.25
338	3.72E+04	7.47	4.57	0.2	12.5	40	50	3	6	51	21.25
339	3.72E+04	8.69	5.79	0.2	12.5	230	50	3	6	51	21.25
340	2.79E+04	6.10	3.66	0.2	12.5	330	50	3	6	51	21.25
341	6.97E+04	0.38	6.40	0.2	12.5	65	50	3	6	51	21.25
342	2.14E+04	3.05	4.57	0.2	22.5	370	75	3	10	96	1.01
343	2.33E+03	2.97	3.05	0.2	12.5	1080	50	2	10	71	64.39
344	1.77E+03	3.58	3.66	0.2	12.5	1000	50	2	10	71	64.39
345	3.04E+03	1.83	2.74	0.2	17.5	700	50	2	10	71	29.82
346	1.03E+03	-999	7.62	0.2	12.5	260	50	3	9	56	127.91
347	7.24E+02	-999	4.57	0.2	12.5	240	50	3	9	56	127.91
348	3.90E+02	0.07	0.00	0.2	22.5	260	50	2	10	92	229.99
349	8.90E+03	1.07	8.08	0.2	12.5	440	17	1	2	39	5.31
350	3.90E+03	2.13	3.84	0.2	17.5	85	50	2	2	13	22.33

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
351	4.07E+04	3.66	1.71	0.2	17.5	840	50	1	10	6	3.61
352	2.18E+04	3.81	2.01	0.2	17.5	1120	22	1	10	6	3.61
353	1.16E+03	-999	0.00	0.2	17.5	590	13	3	1	79	137.50
354	2.92E+03	-999	0.00	0.2	7.5	330	27	1	9	66	7.02
355	2.02E+04	2.44	1.52	0.2	22.5	1115	50	2	4	78	6.81
356	4.86E+04	11.46	7.47	0.2	22.5	1115	50	2	4	78	6.81
357	4.86E+04	11.46	7.47	0.2	22.5	1100	50	2	4	78	6.81
358	4.86E+04	11.46	7.47	0.2	22.5	970	50	2	4	78	6.81
359	4.86E+04	11.46	7.47	0.2	22.5	1360	50	2	4	78	6.81
360	2.83E+04	3.66	4.88	0.2	22.5	220	50	2	4	78	6.81
361	3.84E+04	2.44	1.52	0.2	22.5	960	50	2	4	78	6.81
362	4.86E+04	11.46	7.47	0.2	22.5	1400	50	2	4	78	6.81
363	8.09E+03	9.07	0.00	0.2	22.5	240	50	2	4	78	6.81
364	4.05E+03	18.15	0.00	0.2	22.5	410	50	2	4	78	6.81
365	2.23E+04	3.30	0.00	0.2	22.5	505	50	2	4	78	6.81
366	1.62E+04	1.83	2.44	0.2	22.5	1295	50	2	4	78	6.81
367	2.83E+04	3.05	3.35	0.2	22.5	635	50	2	4	78	6.81
368	7.73E+05	3.66	0.00	0.2	22.5	295	50	2	4	78	6.81
369	7.47E+03	4.02	5.37	0.2	22.5	395	50	2	4	78	6.81
370	2.02E+04	3.66	4.88	0.2	22.5	255	50	2	4	78	6.81
371	4.86E+04	11.46	7.47	0.2	22.5	1650	50	2	4	78	6.81
372	3.48E+05	3.35	0.30	0.2	22.5	115	50	2	4	78	6.81
373	4.86E+04	11.46	7.47	0.2	22.5	1380	50	2	4	78	6.81

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
374	2.43E+04	3.05	4.27	0.2	22.5	495	50	2	4	78	6.81
375	4.05E+04	4.86	7.47	0.2	22.5	815	50	2	4	78	6.81
376	4.86E+04	11.46	7.47	0.2	22.5	985	50	2	4	78	6.81
377	4.86E+04	11.46	7.47	0.2	22.5	1155	50	2	4	78	6.81
378	4.86E+04	5.18	0.61	0.2	22.5	1380	50	2	4	78	6.81
379	4.86E+04	11.46	7.47	0.2	22.5	1500	50	2	4	78	6.81
380	4.86E+04	11.46	7.47	0.2	22.5	1540	50	2	4	78	6.81
381	2.14E+05	2.90	3.35	0.2	22.5	40	50	2	4	78	6.81
382	1.62E+03	-999	0.00	0.2	17.5	40	50	1	5	13	19.70
383	1.62E+03	-999	0.00	0.2	17.5	110	50	1	5	13	19.70
384	1.62E+05	-999	0.00	0.2	17.5	5000	50	1	5	13	19.70
385	1.21E+04	-999	0.00	0.2	17.5	340	50	1	5	13	19.70
386	5.26E+03	-999	0.00	0.2	17.5	200	50	1	5	13	19.70
387	5.26E+03	-999	0.00	0.2	17.5	200	50	2	5	13	19.70
388	5.26E+04	-999	0.00	0.2	17.5	410	50	1	5	13	19.70
389	1.83E+04	0.38	1.60	0.2	12.5	1075	50	1	6	56	38.75
390	2.15E+04	0.87	1.55	0.2	12.5	1100	50	1	6	56	38.75
391	1.70E+03	1.78	1.25	0.2	12.5	1125	50	1	6	56	38.75
392	8.09E+03	1.68	4.18	0.2	17.5	485	50	3	10	80	3.40
393	9.71E+02	2.44	0.00	0.2	17.5	120	50	3	10	80	3.40
394	1.58E+05	1.98	2.13	0.2	17.5	215	50	3	10	80	3.40
395	7.69E+04	2.44	3.54	0.2	17.5	20	50	3	10	80	3.40
396	6.84E+05	1.22	2.56	0.2	17.5	405	50	1	10	80	3.40

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
397	1.58E+05	4.88	2.07	0.2	17.5	1350	50	3	10	80	3.40
398	8.09E+03	1.68	4.48	0.2	17.5	350	50	3	10	80	3.40
399	2.67E+05	3.66	2.99	0.2	17.5	245	50	3	10	80	3.40
400	1.21E+04	1.68	4.39	0.2	17.5	40	50	3	10	80	3.40
401	5.11E+03	2.13	3.05	0.2	7.5	70	50	3	4	42	6.81
402	5.11E+03	1.83	3.05	0.2	7.5	80	50	3	4	42	6.81
403	5.11E+03	0.61	3.05	0.2	7.5	80	50	3	4	42	6.81
404	1.84E+04	6.72	0.00	0.2	17.5	370	50	3	2	15	7.67
405	2.07E+04	1.22	2.13	0.2	17.5	445	50	3	2	15	7.67
406	4.37E+05	1.28	0.09	0.2	17.5	60	50	3	2	15	7.67
407	5.26E+04	0.77	0.00	0.2	17.5	460	50	3	2	15	7.67
408	7.53E+03	1.52	1.83	0.2	17.5	445	50	3	2	15	7.67
409	2.95E+05	0.58	1.40	0.2	17.5	30	50	3	2	15	7.67
410	1.16E+03	1.83	2.44	0.2	12.5	360	5	3	7	89	38.75
411	7.29E+03	2.29	6.55	0.2	12.5	140	37	3	7	89	38.75
412	1.86E+03	-999	2.59	0.2	12.5	130	20	3	7	89	38.75
413	9.80E+00	1.14	2.29	0.2	17.5	60	50	3	1	77	10.91
414	4.65E+03	1.76	3.96	0.2	12.5	185	50	3	9	42	7.67
415	1.86E+04	2.13	3.66	0.2	12.5	220	50	3	9	42	7.67
416	1.86E+04	2.29	3.81	0.2	12.5	220	50	3	9	42	7.67
417	7.28E+04	16.11	0.00	0.2	22.5	40	50	2	4	76	3.61
418	2.38E+04	4.27	2.90	0.2	7.5	1180	50	2	8	31	29.82
419	2.38E+04	4.27	2.90	0.2	7.5	1170	50	2	8	31	29.82

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
420	1.77E+03	2.13	3.05	0.2	12.5	20	29	2	7	84	6.81
421	1.63E+03	1.68	2.59	0.2	12.5	20	29	2	7	84	6.81
422	1.95E+03	1.22	2.74	0.2	12.5	40	29	2	7	84	6.81
423	3.72E+03	1.95	3.32	0.2	12.5	40	29	2	7	84	6.81
424	2.91E+04	-999	3.05	0.2	17.5	5000	32	3	5	13	28.76
425	2.91E+04	3.05	3.05	0.2	17.5	5000	32	3	5	13	28.76
426	1.30E+03	-999	0.00	0.2	7.5	300	15	1	5	3	164.74
427	1.77E+04	0.94	2.44	0.2	17.5	5000	50	1	6	90	117.25
428	5.57E+02	2.04	0.00	0.2	17.5	5000	50	1	6	90	117.25
429	1.94E+02	1.91	1.78	0.2	12.5	40	50	1	2	39	23.36
430	1.30E+03	-999	0.00	0.2	12.5	170	50	1	2	39	23.36
431	6.69E+02	0.46	0.00	0.2	17.5	810	50	3	12	89	6.81
432	2.91E+04	3.66	2.74	0.2	17.5	1115	50	3	12	89	6.81
433	3.86E+03	1.83	7.32	0.2	17.5	575	50	3	12	89	6.81
434	4.65E+05	2.74	2.44	0.2	17.5	105	50	3	12	89	6.81
435	2.31E+05	4.57	4.57	0.2	17.5	270	50	3	12	89	6.81
436	1.01E+05	4.57	3.96	0.2	17.5	795	50	3	12	89	6.81
437	6.96E+03	5.18	3.81	0.2	17.5	565	50	3	12	89	6.81
438	6.96E+03	5.18	3.81	0.2	17.5	525	50	3	12	89	6.81
439	7.81E+03	2.44	0.00	0.2	7.5	900	50	2	4	98	7.67
440	5.95E+03	1.27	0.00	0.2	7.5	550	50	2	6	25	7.67
441	1.63E+03	2.07	0.00	0.2	7.5	300	50	2	6	25	7.67
442	2.69E+03	1.89	0.00	0.2	7.5	300	50	2	6	25	7.67

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
443	1.74E+02	0.46	1.52	0.2	17.5	420	14	3	2	95	216.36
444	6.09E+02	0.15	1.07	0.2	17.5	420	14	3	2	95	216.36
445	1.21E+03	1.83	2.44	0.2	27.5	550	50	2	6	102	7.21
446	1.39E+04	4.26	3.67	0.2	12.5	210	50	2	10	72	117.25
447	1.78E+03	2.74	3.05	0.2	12.5	610	50	2	10	72	117.25
448	2.01E+03	1.83	1.53	0.2	12.5	670	50	2	10	72	117.25
449	3.58E+03	0.30	3.90	0.2	12.5	440	50	2	10	72	117.25
450	3.09E+03	1.30	0.00	0.2	12.5	500	50	2	10	72	117.25
451	1.24E+03	1.45	0.00	0.2	12.5	40	50	2	10	72	117.25
452	1.24E+03	0.02	0.00	0.2	12.5	30	50	2	10	72	117.25
453	1.39E+04	3.89	3.38	0.2	12.5	320	50	2	10	72	117.25
454	1.74E+03	2.74	3.05	0.2	12.5	600	50	2	10	72	117.25
455	6.88E+03	2.44	2.51	0.2	12.5	280	50	2	10	72	117.25
456	2.85E+02	1.30	4.18	0.2	12.5	280	50	2	10	72	123.57
457	2.86E+02	1.81	4.18	0.2	12.5	280	50	2	10	72	123.57
458	2.36E+05	0.91	0.00	0.2	22.5	300	50	2	4	76	3.61
459	7.70E+03	-999	0.00	0.2	22.5	700	50	2	4	76	3.61
460	2.88E+04	-999	0.00	0.2	22.5	0	50	2	4	76	3.61
461	1.35E+05	0.91	0.00	0.2	22.5	0	50	2	4	76	3.61
462	5.71E+04	0.91	0.00	0.2	22.5	40	50	2	4	76	3.61
463	5.32E+05	0.91	0.00	0.2	22.5	20	50	2	4	76	3.61
464	6.19E+04	0.91	0.00	0.2	22.5	20	50	2	4	76	3.61
465	2.16E+05	0.91	0.00	0.2	22.5	200	50	2	4	76	3.61

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
466	1.01E+05	1.29	0.00	0.2	22.5	5000	50	2	4	76	3.61
467	8.10E+04	-999	0.00	0.2	22.5	0	50	2	4	76	3.61
468	6.13E+02	3.10	4.63	0.2	17.5	190	50	3	1	79	38.75
469	2.02E+02	-999	0.00	0.2	12.5	395	27	1	5	3	1.01
470	2.31E+05	-999	0.00	0.2	12.5	65	38	2	7	3	1.01
471	5.30E+03	0.61	0.15	0.2	22.5	600	50	2	10	92	7.21
472	4.27E+03	0.61	1.83	0.2	22.5	800	50	2	10	92	7.21
473	5.64E+03	1.83	1.83	0.2	22.5	840	50	2	10	92	7.21
474	4.16E+03	0.61	1.86	0.2	22.5	740	50	2	10	92	7.21
475	2.79E+03	4.54	0.27	0.2	22.5	640	50	2	10	92	7.21
476	6.04E+02	1.22	0.46	0.2	22.5	640	50	2	10	92	7.21
477	9.75E+03	0.30	0.46	0.2	22.5	440	50	2	10	92	7.21
478	1.86E+03	1.77	0.30	0.2	22.5	500	50	2	10	92	7.21
479	1.02E+03	0.73	0.27	0.2	22.5	530	50	2	10	92	7.21
480	8.36E+02	0.01	0.00	0.2	22.5	5000	17	1	10	92	164.74
481	7.04E+03	0.76	2.29	0.2	7.5	220	50	2	2	7	7.67
482	4.06E+04	2.44	3.96	0.2	7.5	240	50	2	2	7	7.67
483	7.28E+02	0.30	0.61	0.2	7.5	800	50	2	2	7	7.67
484	1.09E+03	0.15	1.52	0.2	7.5	740	50	2	2	7	7.67
485	2.31E+03	0.61	4.27	0.2	7.5	600	50	2	2	7	7.67
486	6.42E+02	1.43	0.91	0.2	7.5	216	50	2	2	7	7.67
487	3.93E+04	0.61	1.22	0.2	7.5	1220	50	2	2	7	7.67
488	1.46E+03	3.05	5.18	0.2	7.5	900	50	2	2	7	7.67

Table D.2 Nationwide Database of Surface Impoundment Sites

Site Number	Area (m ²)	Operating Depth (m)	Base Depth Below Grade (m)	Total Thickness of Sediment (m)	Soil/GW Temp. (° C)	Distance to Nearest SW Body (m)	Operating Life/Leaching Duration (yr)	Soil Type	HG Environment	Nearest Climate Center	Site Weighting
489	2.22E+04	0.23	0.99	0.2	7.5	810	50	2	2	7	7.67
490	2.33E+04	1.83	2.13	0.2	7.5	1390	50	1	2	7	7.67
491	1.44E+03	1.22	1.83	0.2	7.5	624	50	2	2	7	7.67
492	1.86E+03	0.30	0.61	0.2	7.5	230	50	2	2	7	7.67
493	4.33E+03	0.91	2.59	0.2	7.5	500	50	2	2	7	7.67
494	7.28E+02	0.91	2.74	0.2	7.5	710	50	2	2	7	7.67
495	3.99E+04	3.96	4.27	0.2	7.5	1080	50	2	2	7	7.67
496	4.69E+04	1.98	2.90	0.2	7.5	960	50	2	2	7	7.67
497	2.02E+02	2.13	1.83	0.2	22.5	5000	27	2	4	94	26.72
498	1.52E+03	0.00	0.00	0.2	17.5	5000	12	2	4	34	25.16
499	1.19E+03	3.20	4.27	0.2	17.5	5000	50	3	1	77	20.95
500	7.41E+03	-999	0.00	0.2	12.5	240	50	3	6	6	216.36
501	1.81E+03	-999	0.00	0.2	12.5	190	50	3	6	6	216.36
502	5.16E+04	-999	0.06	0.2	12.5	150	50	3	6	6	216.36
503	7.00E+01	0.06	0.76	0.2	22.5	480	6	3	10	96	7.02

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Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m ²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
1	1.01E+02	1.71E-01	12.5	2	39	10
2	3.78E+02	1.60E+00	12.5	12	69	10
3	1.21E+02	7.46E+00	17.5	4	90	1
4	1.21E+02	2.10E-01	12.5	12	54	1
5	4.45E+02	2.52E+01	12.5	12	53	1
6	8.09E+01	2.23E-01	17.5	1	79	1
7	5.20E+03	4.79E-02	12.5	2	52	1
8	8.09E+01	7.27E+00	12.5	5	74	1
9	1.35E+03	3.47E-01	22.5	4	58	1
10	3.24E+02	1.40E+01	12.5	12	85	1
11	1.21E+03	9.32E-02	17.5	12	89	1
12	6.07E+02	3.73E-02	12.5	12	42	1
13	6.20E+05	9.65E-07	12.5	12	69	1
14	1.21E+02	2.62E+00	7.5	2	32	1
15	2.43E+02	6.90E-01	17.5	13	90	1
16	6.75E+00	1.34E+02	22.5	4	92	1
17	6.07E+02	5.13E-02	12.5	2	53	1
18	4.05E+01	1.68E+00	17.5	4	95	1
19	2.10E+03	1.38E-01	12.5	12	32	20
20	3.64E+02	1.49E-01	12.5	8	82	20
21	8.09E+01	6.71E-01	12.5	12	42	20
22	4.05E+03	4.47E-02	12.5	4	66	20
23	4.05E+01	2.24E-01	17.5	5	1	20
24	4.86E+03	5.03E-01	17.5	12	93	3
25	4.05E+01	2.22E-02	22.5	4	91	3
26	1.21E+02	8.95E+00	12.5	4	56	3
27	2.02E+01	3.69E+01	12.5	2	71	3
28	2.02E+04	1.12E-03	17.5	4	79	3
29	2.02E+01	1.34E+01	22.5	4	81	3
30	5.58E+03	-9.99E+02	7.5	2	32	3
31	1.21E+02	2.24E+01	12.5	9	51	3
32	1.62E+02	2.01E+01	17.5	5	12	3
33	5.58E+03	1.05E-02	12.5	12	71	3
34	2.02E+01	-9.99E+02	12.5	5	26	3
35	3.24E+04	1.23E+00	12.5	4	74	3
36	2.02E+01	2.24E+01	12.5	12	51	3
37	2.02E+01	4.65E+00	22.5	4	79	3
38	1.21E+02	2.24E+00	12.5	2	66	3
39	2.43E+02	5.22E+00	12.5	2	53	3
40	2.02E+03	8.95E-02	12.5	2	71	3
41	2.02E+01	2.15E+00	12.5	2	66	3
42	2.43E+04	8.76E-02	22.5	4	92	3
43	8.09E+01	1.23E+00	12.5	2	88	3
44	1.01E+03	3.56E-01	17.5	4	80	3

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
45	4.05E+01	4.47E+00	12.5	12	42	3
46	1.08E+02	1.01E+01	17.5	1	95	3
47	4.05E+01	1.01E+00	12.5	4	66	3
48	1.62E+02	2.10E+00	7.5	2	32	3
49	1.21E+03	1.12E+00	12.5	9	42	3
50	4.05E+01	3.13E+01	12.5	8	42	3
51	8.09E+01	1.85E-02	12.5	4	74	3
52	1.01E+03	1.79E+01	12.5	2	59	3
53	2.02E+01	3.95E-02	7.5	5	3	3
54	2.02E+01	1.10E+01	12.5	2	71	3
55	2.02E+02	1.12E-01	12.5	2	88	3
56	1.86E+04	9.75E-03	7.5	4	60	3
57	8.09E+01	4.92E-01	12.5	9	51	3
58	8.09E+01	3.95E-02	12.5	5	29	3
59	2.63E+04	-9.99E+02	12.5	4	52	3
60	2.02E+01	3.95E-02	17.5	4	80	3
61	4.05E+01	3.80E-01	12.5	2	71	3
62	1.62E+02	7.92E-01	7.5	2	48	3
63	2.02E+02	1.86E-01	12.5	12	85	3
64	2.02E+01	1.34E+02	17.5	12	89	3
65	4.05E+02	3.35E-02	22.5	4	58	3
66	2.83E+02	9.59E-01	7.5	12	32	3
67	6.88E+02	2.63E+00	12.5	4	39	3
68	9.31E+02	3.65E-01	17.5	2	58	3
69	2.02E+01	1.32E+02	12.5	12	85	3
70	2.02E+01	4.04E-01	12.5	2	74	3
71	4.05E+01	5.37E+00	12.5	12	50	3
72	2.79E+03	-9.99E+02	12.5	4	51	3
73	4.05E+01	6.98E+01	12.5	4	51	3
74	2.43E+03	7.46E-02	12.5	2	52	3
75	2.02E+01	8.95E+00	17.5	13	34	3
76	1.00E+05	1.36E-01	12.5	5	26	1
77	2.02E+01	1.97E+01	12.5	12	42	1
78	8.99E+03	1.79E+01	12.5	9	42	1
79	2.43E+02	2.24E+01	22.5	4	81	1
80	4.05E+03	3.36E-01	22.5	4	91	1
81	4.05E+02	1.23E+00	12.5	4	71	1
82	1.08E+02	3.75E+01	12.5	6	74	1
83	2.70E+01	4.59E+01	12.5	2	66	1
84	2.02E+01	1.23E+02	17.5	4	95	1
85	2.02E+02	8.95E+00	12.5	12	42	1
86	8.63E+02	5.77E+00	17.5	12	85	1
87	1.16E+04	7.40E+00	12.5	12	49	1
88	4.05E+03	2.24E-01	12.5	5	69	1

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
89	7.45E+04	3.65E-01	12.5	4	52	1
90	9.31E+02	1.46E-01	12.5	4	66	1
91	9.44E+01	5.59E+00	17.5	12	95	1
92	4.05E+04	1.79E-02	17.5	1	95	1
93	4.28E+03	1.16E+00	12.5	12	88	1
94	2.02E+01	8.95E+00	12.5	12	52	1
95	5.61E+03	2.53E+00	22.5	4	81	1
96	1.62E+02	3.50E+01	12.5	4	72	1
97	1.21E+04	5.97E+00	12.5	12	49	1
98	5.58E+03	1.22E-01	12.5	2	66	1
99	2.02E+02	2.91E+00	12.5	2	66	1
100	2.02E+03	1.40E-01	7.5	13	66	1
101	2.02E+01	5.38E-01	17.5	2	36	1
102	6.07E+05	1.19E+00	12.5	2	69	1
103	1.11E+03	4.88E-02	12.5	2	52	1
104	1.34E+03	1.48E-01	22.5	4	96	1
105	8.09E+01	5.60E-01	12.5	8	32	1
106	2.10E+03	7.74E-01	12.5	2	74	1
107	4.05E+01	7.05E+00	12.5	12	42	1
108	4.05E+01	2.24E+02	12.5	2	69	1
109	1.21E+02	9.69E+01	17.5	12	95	1
110	4.05E+01	1.73E-02	12.5	1	71	1
111	8.09E+01	1.17E+01	7.5	2	50	1
112	1.62E+02	8.18E+00	12.5	2	39	1
113	1.01E+02	1.61E+01	12.5	1	75	1
114	4.05E+03	1.12E-02	17.5	4	93	1
115	2.33E+02	4.86E+00	12.5	4	74	1
116	9.44E+03	2.08E+00	17.5	12	95	1
117	4.05E+03	8.05E-02	12.5	12	71	1
118	2.02E+01	1.34E+02	7.5	8	32	1
119	2.02E+02	5.37E+01	12.5	2	66	1
120	5.67E+04	8.63E-04	12.5	4	52	1
121	2.43E+02	3.54E+01	12.5	9	51	1
122	4.05E+01	3.27E+02	12.5	4	72	1
123	1.42E+02	-9.99E+02	12.5	12	42	1
124	5.67E+04	1.64E-02	12.5	5	3	1
125	1.62E+02	1.29E+00	12.5	12	42	1
126	1.89E+02	4.15E+01	12.5	4	51	1
127	2.02E+01	1.68E+02	7.5	12	48	1
128	2.16E+04	2.80E+00	7.5	2	32	1
129	6.48E+02	1.96E+00	12.5	12	71	1
130	2.02E+01	1.66E+01	12.5	2	74	1
131	2.02E+03	5.22E+00	17.5	12	89	1
132	1.21E+04	8.95E-01	12.5	13	82	1

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
133	8.09E+01	-9.99E+02	12.5	12	42	1
134	1.56E+02	2.67E+01	12.5	12	42	1
135	2.10E+03	1.08E-01	7.5	4	47	1
136	4.05E+04	5.59E-02	12.5	9	42	1
137	4.05E+01	5.59E+00	12.5	6	73	1
138	6.27E+03	7.16E-04	22.5	4	81	1
139	1.21E+04	-9.99E+02	12.5	2	66	1
140	4.05E+01	1.68E-01	12.5	13	71	1
141	2.43E+02	3.36E+02	12.5	2	52	1
142	6.48E+02	-9.99E+02	12.5	2	66	1
143	1.01E+04	4.75E-01	12.5	2	52	1
144	2.02E+01	6.44E+01	7.5	4	84	1
145	4.05E+03	8.05E-02	12.5	12	71	1
146	1.86E+03	8.75E-01	12.5	2	39	1
147	3.97E+03	5.24E-02	12.5	2	52	1
148	1.21E+02	-9.99E+02	12.5	4	27	1
149	4.45E+02	6.10E+00	12.5	2	52	1
150	1.52E+03	7.27E-01	12.5	9	42	1
151	7.45E+03	1.80E+00	12.5	4	72	1
152	8.09E+03	5.59E-01	12.5	2	39	1
153	3.91E+02	1.93E+00	7.5	13	45	1
154	4.05E+01	-9.99E+02	12.5	1	75	1
155	1.42E+03	4.79E+00	12.5	2	71	1
156	8.09E+01	1.39E-01	12.5	9	42	1
157	1.25E+03	1.67E+00	7.5	2	32	1
158	6.07E+01	9.32E+00	17.5	12	89	1
159	9.20E+02	1.18E+02	12.5	9	42	1
160	3.64E+02	4.97E-01	12.5	12	51	1
161	9.31E+02	2.43E-01	12.5	12	51	1
162	9.31E+02	1.95E+00	12.5	2	39	1
163	8.09E+01	3.99E+00	12.5	12	69	1
164	6.88E+02	3.29E-01	7.5	12	45	1
165	8.09E+02	9.02E-01	7.5	13	4	1
166	1.51E+04	5.71E-01	7.5	4	60	1
167	5.22E+03	3.69E-02	7.5	8	32	1
168	4.05E+03	4.03E+00	12.5	2	74	1
169	4.05E+03	2.07E-01	17.5	4	95	1
170	4.05E+03	1.12E-02	22.5	12	57	1
171	2.02E+02	2.24E-01	17.5	13	90	1
172	2.70E+03	2.51E-01	7.5	12	48	1
173	5.58E+03	7.29E-02	12.5	5	40	1
174	4.45E+02	5.08E-01	17.5	5	12	1
175	9.75E+03	1.58E+00	17.5	2	37	1
176	1.01E+03	1.23E-05	12.5	8	9	1
177	3.24E+02	8.11E-02	17.5	5	34	1

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
178	6.07E+03	2.98E-02	12.5	12	50	1
179	4.05E+01	1.33E-01	22.5	12	76	1
180	4.05E+01	5.60E-01	22.5	4	92	1
181	2.02E+03	6.71E-02	7.5	13	5	1
182	2.02E+03	1.57E-01	22.5	5	92	1
183	1.47E+06	4.88E-01	22.5	12	57	1
184	1.82E+03	4.65E-02	17.5	13	29	1
185	9.31E+02	1.23E-01	17.5	13	29	1
186	1.01E+05	8.95E-02	22.5	4	92	1
187	2.02E+04	2.06E+00	12.5	1	71	1
188	1.42E+06	1.92E+00	22.5	12	57	1
189	6.07E+02	1.12E+01	22.5	4	92	1
190	1.15E+06	4.29E-01	22.5	4	92	1
191	2.02E+01	1.45E+00	12.5	13	71	1
192	3.04E+05	5.22E-01	22.5	12	57	1
193	4.05E+03	2.24E-03	17.5	4	30	1
194	2.83E+02	1.59E-02	17.5	2	77	1
195	2.02E+01	5.28E+00	12.5	12	51	1
196	4.45E+02	4.06E-02	17.5	4	90	1
197	8.09E+04	2.24E-02	12.5	4	48	1
198	2.02E+03	4.47E-01	17.5	2	36	1
199	2.02E+02	4.47E-01	17.5	12	79	1
200	2.02E+01	4.93E-03	17.5	4	90	22
201	2.79E+03	6.43E-04	12.5	8	55	22
202	8.09E+01	8.38E-02	17.5	1	95	3
203	1.01E+01	9.86E-03	22.5	4	81	3
204	9.96E+03	4.55E-01	12.5	5	33	3
205	4.05E+01	6.73E-01	17.5	12	90	3
206	8.09E+01	2.71E-02	17.5	4	69	3
207	2.09E+04	1.64E+00	12.5	2	39	3
208	2.02E+01	4.14E+00	17.5	4	90	3
209	2.02E+01	1.13E-01	12.5	13	19	3
210	9.31E+02	7.50E-04	17.5	4	90	3
211	8.50E+02	5.87E-05	12.5	5	56	1
212	3.64E+02	3.35E+00	12.5	1	67	1
213	1.05E+03	2.31E-03	12.5	4	71	1
214	3.04E+03	3.06E-01	17.5	4	69	1
215	9.31E+02	2.34E-02	17.5	12	89	1
216	8.09E+01	1.73E-02	22.5	12	78	1
217	2.02E+01	1.23E-01	17.5	5	12	1
218	1.94E+03	1.03E+00	12.5	12	73	1
219	1.01E+01	-9.99E+02	22.5	12	78	1
220	1.39E+04	2.87E-05	17.5	5	13	1
221	1.01E+01	2.71E-01	7.5	5	3	1

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
222	3.04E+04	1.41E+01	12.5	5	69	1
223	4.05E+02	1.84E-01	12.5	9	42	1
224	2.02E+02	6.71E+00	12.5	12	42	1
225	2.02E+01	2.47E-01	17.5	5	12	1
226	2.48E+05	-9.99E+02	22.5	4	96	1
227	1.01E+04	-9.99E+02	17.5	1	69	1
228	8.09E+01	1.40E+01	12.5	12	42	1
229	1.50E+04	5.76E-01	12.5	2	39	1
230	4.05E+01	1.12E+01	17.5	5	21	1
231	2.02E+03	2.01E-01	7.5	5	10	1
232	1.50E+03	2.66E-01	7.5	1	64	1
233	2.02E+04	2.17E+00	12.5	4	56	1
234	4.05E+03	4.19E+00	12.5	12	19	1
235	4.05E+01	8.29E-01	17.5	13	13	1
236	2.02E+01	1.13E-01	17.5	13	77	8
237	2.02E+03	2.24E-02	17.5	4	95	1
238	8.09E+03	1.12E-03	22.5	4	58	1
239	1.62E+02	4.05E+01	12.5	5	74	1
240	4.05E+01	2.35E+01	12.5	4	72	1
241	1.86E+03	3.04E-02	12.5	4	73	1
242	1.35E+01	1.11E-01	12.5	12	51	1
243	1.13E+03	4.99E+00	12.5	12	50	1
244	2.02E+01	2.96E-01	12.5	2	88	1
245	1.01E+06	1.34E+00	22.5	12	57	1
246	8.09E+01	1.58E+00	12.5	1	65	1
247	4.05E+01	6.76E-01	22.5	4	92	1
248	5.40E+03	4.19E-02	12.5	5	40	2
249	3.72E+03	1.22E-02	12.5	2	54	2
250	1.13E+03	7.93E-04	17.5	1	79	2
251	6.75E+02	6.04E-02	12.5	4	51	2
252	6.88E+02	8.55E-01	12.5	2	51	2
253	9.29E+03	2.26E-02	12.5	12	54	2
254	6.07E+01	1.49E-01	12.5	5	56	2
255	4.05E+03	1.79E+00	12.5	2	33	2
256	1.62E+04	1.68E+01	17.5	4	74	2
257	4.05E+01	2.71E-02	12.5	8	46	2
258	9.31E+02	2.92E+00	17.5	5	12	2
259	1.62E+04	5.59E-02	17.5	4	79	2
260	1.21E+02	3.58E-01	22.5	4	81	2
261	1.21E+02	2.24E+00	22.5	12	57	2
262	2.02E+01	1.78E-01	17.5	13	90	1
263	2.02E+03	4.47E-02	12.5	12	55	1
264	4.45E+02	5.08E+00	22.5	5	92	1
265	4.86E+03	4.66E-02	12.5	13	20	1

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
266	3.62E+04	1.90E+00	17.5	1	89	1
267	1.00E+04	2.84E-02	17.5	5	74	1
268	1.52E+03	5.67E-01	12.5	4	74	1
269	1.94E+06	6.52E-01	22.5	4	20	1
270	1.30E+06	1.82E+01	22.5	12	57	1
271	2.91E+05	1.55E+00	22.5	12	57	1
272	4.65E+04	5.44E-02	22.5	4	92	1
273	4.05E+03	4.47E-02	7.5	8	32	1
274	2.63E+02	1.55E-01	12.5	2	66	1
275	2.99E+04	1.36E+00	17.5	12	89	1
276	1.21E+04	8.96E-04	17.5	12	87	1
277	1.21E+02	4.59E+00	22.5	4	81	1
278	7.64E+04	3.26E-01	22.5	4	20	1
279	4.05E+03	2.24E-02	12.5	13	72	1
280	4.25E+05	2.66E+00	17.5	2	80	1
281	4.46E+04	1.52E-02	12.5	1	71	1
282	9.31E+02	1.22E-01	22.5	4	92	1
283	8.09E+03	9.86E-05	22.5	4	35	1
284	4.99E+05	3.45E+00	22.5	12	78	1
285	1.89E+05	9.59E-01	7.5	13	5	1
286	1.42E+02	8.10E-03	17.5	4	74	1
287	2.06E+03	2.19E-01	12.5	13	86	1
288	5.03E+04	1.08E-01	17.5	5	13	1
289	2.02E+03	1.01E-01	22.5	4	96	1
290	4.05E+01	3.08E+00	12.5	4	74	1
291	4.45E+04	9.97E-01	17.5	1	95	1
292	1.30E+03	1.75E-01	22.5	12	93	1
293	4.05E+01	3.92E+00	22.5	4	35	30
294	2.02E+01	-9.99E+02	12.5	9	42	30
295	4.05E+01	-9.99E+02	22.5	4	81	30
296	4.05E+02	4.44E-03	12.5	2	71	30
297	2.02E+01	4.47E+00	17.5	5	12	30
298	2.02E+01	5.03E-01	7.5	4	75	30
299	4.05E+03	5.60E-03	12.5	12	54	30
300	2.02E+03	6.71E-02	22.5	4	92	30
301	6.75E+00	1.18E-01	22.5	13	92	30
302	2.02E+01	8.88E-02	22.5	12	57	30
303	2.43E+02	6.99E-03	7.5	2	48	30
304	1.21E+03	1.89E-03	17.5	12	95	30
305	6.88E+02	-9.99E+02	22.5	4	92	30
306	4.17E+03	8.69E+00	7.5	8	32	30
307	2.02E+01	4.49E-01	17.5	13	37	30
308	1.62E+02	1.05E-01	7.5	2	32	30
309	2.02E+01	1.78E-01	17.5	4	90	30

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
310	8.09E+01	5.59E+00	12.5	13	74	30
311	5.67E+02	1.60E-01	17.5	2	36	30
312	4.05E+01	3.36E+00	12.5	12	42	30
313	2.02E+01	8.93E-01	7.5	2	43	30
314	3.72E+03	2.43E+00	12.5	12	85	30
315	4.05E+03	8.88E-04	7.5	2	31	30
316	1.21E+02	8.39E-01	12.5	8	46	30
317	8.09E+01	1.01E+02	22.5	4	14	30
318	1.21E+04	7.46E-01	17.5	2	58	30
319	4.45E+02	6.10E-01	17.5	1	69	30
320	7.01E+02	8.60E-02	17.5	4	90	30
321	2.02E+03	1.68E-03	12.5	1	71	30
322	4.05E+02	8.88E-03	17.5	12	79	30
323	2.02E+01	1.97E-02	17.5	5	12	30
324	2.02E+01	1.79E+01	12.5	5	69	30
325	1.01E+04	2.24E-03	22.5	12	57	30
326	4.05E+01	3.92E-01	12.5	5	19	30
327	2.02E+01	3.58E+00	17.5	4	90	30
328	2.02E+01	2.24E+00	7.5	12	48	30
329	2.02E+01	6.90E-02	12.5	9	42	30
330	8.09E+01	1.68E-01	12.5	8	46	30
331	4.05E+01	3.92E+00	7.5	13	49	30
332	2.02E+01	9.37E-02	12.5	4	74	30
333	2.02E+01	3.16E-01	12.5	2	53	30
334	2.02E+03	5.57E-03	22.5	4	92	9
335	8.09E+01	1.01E-01	17.5	12	95	9
336	2.02E+01	8.93E-01	17.5	4	77	9
337	2.02E+02	2.80E-01	22.5	12	91	9
338	4.05E+01	2.33E+01	12.5	12	42	9
339	4.65E+02	8.75E-01	17.5	2	36	9
340	4.05E+02	6.71E-02	17.5	5	13	9
341	2.02E+01	-9.99E+02	12.5	2	71	9
342	1.01E+03	3.31E-02	17.5	12	89	9
343	4.05E+01	2.79E-01	12.5	4	66	9
344	4.05E+02	4.19E-02	7.5	1	44	9
345	4.05E+03	1.12E-02	17.5	4	90	9
346	3.72E+03	1.52E-02	12.5	2	31	9
347	2.02E+03	5.37E-02	12.5	1	71	9
348	4.45E+02	6.59E-02	17.5	12	95	9
349	2.02E+02	4.44E-03	17.5	4	36	9
350	2.02E+03	7.74E-01	22.5	4	92	9
351	2.02E+01	2.91E+00	7.5	5	3	9
352	4.05E+03	8.39E+00	17.5	4	79	9
353	2.14E+05	9.96E-01	17.5	8	74	9
354	6.88E+02	6.58E+00	12.5	12	32	9

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
355	2.02E+01	4.47E+00	7.5	12	48	9
356	2.02E+01	8.88E-02	17.5	1	79	9
357	4.05E+03	2.24E-02	22.5	12	91	9
358	3.52E+04	2.35E-01	12.5	4	84	9
359	9.31E+02	1.82E-02	22.5	12	93	9
360	4.05E+01	1.23E+01	22.5	12	97	9
361	6.07E+03	-9.99E+02	12.5	12	72	9
362	3.44E+03	4.95E-01	12.5	13	32	9
363	4.45E+02	7.63E-01	22.5	12	91	9
364	6.75E+02	2.49E-02	22.5	12	97	9
365	8.09E+01	1.12E+01	12.5	12	87	9
366	6.07E+03	7.46E-03	17.5	5	14	9
367	2.43E+02	2.79E-02	22.5	11	57	9
368	2.43E+02	1.49E-01	22.5	4	96	9
369	1.21E+03	2.24E-01	12.5	8	54	9
370	8.09E+03	4.14E-02	17.5	13	20	9
371	6.07E+03	2.98E-01	12.5	4	66	9
372	2.79E+03	8.11E-03	7.5	4	31	9
373	1.35E+01	2.80E+01	12.5	5	26	9
374	9.31E+02	8.75E+00	12.5	12	42	9
375	2.02E+01	4.44E-02	12.5	1	8	9
376	3.56E+03	6.36E-02	17.5	4	92	9
377	1.62E+04	4.19E-03	17.5	1	77	9
378	8.09E+03	6.16E-06	17.5	5	12	9
379	1.21E+02	1.49E+00	12.5	2	59	9
380	1.21E+04	2.24E+00	7.5	4	25	9
381	9.31E+02	4.87E-02	12.5	4	13	9
382	2.02E+01	2.80E+00	17.5	2	36	9
383	3.64E+02	1.99E-01	7.5	2	32	9
384	5.67E+02	2.00E-01	22.5	4	35	9
385	8.09E+03	3.36E-01	17.5	1	69	9
386	4.05E+01	2.68E+01	17.5	4	90	9
387	1.01E+01	4.44E-02	17.5	5	13	9
388	1.01E+01	1.17E+01	22.5	4	92	9
389	4.45E+02	5.08E+00	7.5	1	65	9
390	8.09E+01	6.71E-01	22.5	4	81	9
391	2.02E+01	1.33E-01	12.5	2	71	9
392	1.42E+02	1.60E+01	22.5	12	78	9
393	8.09E+01	1.12E-01	7.5	4	6	9
394	8.09E+03	5.59E-01	12.5	8	82	9
395	6.07E+03	1.12E+01	12.5	4	51	9
396	8.09E+01	-9.99E+02	7.5	2	45	9
397	2.02E+03	1.40E-02	17.5	1	79	9
398	4.05E+01	3.35E-01	12.5	5	26	9

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
399	1.21E+03	3.70E-03	12.5	9	42	9
400	4.65E+03	1.94E-02	12.5	4	19	9
401	1.01E+03	2.24E-02	22.5	12	76	9
402	6.07E+02	1.86E+00	12.5	4	65	9
403	6.07E+02	9.32E-01	7.5	4	10	9
404	1.21E+02	1.40E-01	17.5	5	53	9
405	1.21E+03	1.49E-02	17.5	2	74	9
406	4.05E+01	2.24E-01	17.5	5	1	9
407	2.83E+02	-9.99E+02	12.5	4	72	9
408	1.38E+03	1.97E+00	17.5	12	95	9
409	2.83E+03	3.20E+00	22.5	2	58	1
410	6.88E+02	1.32E-01	17.5	5	12	9
411	8.09E+01	1.68E-01	12.5	4	51	9
412	4.05E+01	5.37E+00	22.5	5	14	9
413	8.09E+03	3.49E-03	17.5	4	69	1
414	4.05E+01	3.35E-01	12.5	8	46	1
415	4.05E+01	3.22E+00	17.5	13	34	1
416	8.50E+02	9.86E-02	12.5	6	51	1
417	4.05E+01	1.79E+01	17.5	5	12	1
418	2.47E+03	1.28E-01	12.5	12	74	1
419	1.42E+02	1.46E+02	12.5	2	71	1
420	8.90E+03	2.24E-05	17.5	8	74	1
421	2.02E+02	2.46E+00	12.5	8	63	1
422	4.05E+01	2.24E+00	12.5	4	72	1
423	1.62E+02	5.59E+01	12.5	9	42	1
424	5.40E+01	1.40E+01	22.5	4	58	1
425	2.27E+04	5.99E-01	7.5	8	32	1
426	8.09E+01	1.39E-01	22.5	4	81	1
427	4.05E+01	3.58E+00	7.5	12	45	1
428	2.63E+02	9.06E-01	17.5	5	34	1
429	4.05E+01	1.23E+01	17.5	5	1	1
430	1.21E+04	1.87E-03	12.5	4	65	1
431	2.02E+02	1.79E+00	12.5	2	74	1
432	1.21E+03	5.44E+00	12.5	12	49	1
433	4.86E+02	3.54E+00	17.5	1	77	1
434	3.64E+02	4.97E-01	12.5	1	61	1
435	4.05E+01	1.04E+02	12.5	4	51	1
436	1.01E+04	1.21E+00	17.5	2	74	1
437	2.23E+04	7.32E-01	12.5	4	39	1
438	8.09E+01	7.94E-01	12.5	9	51	1
439	2.02E+02	1.68E+01	12.5	12	49	1
440	1.62E+04	4.19E-01	22.5	12	78	1
441	4.65E+02	1.70E+00	17.5	5	12	1
442	2.02E+03	2.68E-01	12.5	12	71	1

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
443	1.38E+03	2.21E-01	12.5	2	69	1
444	1.27E+03	1.67E+00	17.5	1	69	1
445	8.09E+01	2.80E-01	22.5	12	78	1
446	4.05E+01	2.80E+01	17.5	5	13	1
447	6.07E+01	4.00E+01	17.5	5	13	1
448	4.05E+04	1.12E-02	22.5	5	12	1
449	1.13E+03	7.19E-02	12.5	2	74	1
450	1.21E+04	1.64E+00	22.5	12	97	1
451	1.50E+03	1.81E+00	12.5	12	42	1
452	3.34E+04	4.26E-02	17.5	4	79	1
453	8.09E+01	1.01E+00	12.5	4	45	1
454	2.23E+02	3.76E-01	12.5	12	85	1
455	8.09E+01	2.80E+00	22.5	12	97	1
456	6.75E+01	-9.99E+02	7.5	2	66	1
457	2.02E+01	2.24E+01	12.5	2	39	1
458	4.05E+01	1.70E+01	7.5	2	48	1
459	8.50E+02	7.99E-01	22.5	4	91	1
460	2.06E+03	8.77E+00	12.5	12	49	1
461	4.05E+01	8.50E+00	12.5	4	51	1
462	2.02E+01	1.79E+00	12.5	5	74	1
463	4.05E+01	1.37E+01	17.5	1	69	1
464	3.64E+02	3.84E-03	12.5	12	87	1
465	1.21E+03	5.59E+00	22.5	12	78	1
466	4.45E+02	1.42E+00	12.5	2	39	1
467	3.64E+02	1.37E-04	12.5	2	45	1
468	2.02E+02	2.01E+00	17.5	5	34	1
469	5.26E+03	5.68E-01	12.5	12	69	1
470	2.02E+05	1.12E-01	12.5	1	71	1
471	2.02E+01	3.28E+00	7.5	2	32	1
472	2.43E+02	2.79E-01	7.5	8	32	1
473	1.11E+04	1.61E-04	17.5	13	34	1
474	2.02E+01	8.95E+00	12.5	2	56	1
475	7.69E+04	2.05E-01	12.5	12	49	1
476	8.09E+03	7.27E-01	12.5	5	56	1
477	3.24E+04	2.32E+00	12.5	5	33	1
478	2.02E+01	-9.99E+02	12.5	4	66	1
479	7.28E+04	8.08E-01	12.5	12	74	1
480	4.05E+03	1.80E-01	17.5	12	89	1
481	4.45E+02	1.14E+01	17.5	5	12	1
482	2.02E+04	7.40E-05	17.5	1	89	1
483	2.02E+01	2.24E-01	22.5	4	81	1
484	1.38E+03	6.58E+00	12.5	4	66	1
485	1.21E+02	-9.99E+02	22.5	4	35	1
486	2.02E+01	8.95E+00	17.5	2	58	1

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
487	1.86E+03	2.43E-01	17.5	4	90	1
488	1.01E+01	1.79E+00	12.5	4	71	1
489	4.05E+04	4.47E-01	12.5	2	66	1
490	4.05E+03	2.24E-01	12.5	4	39	1
491	2.02E+03	8.38E-04	22.5	13	36	1
492	1.21E+02	1.86E+03	22.5	5	12	1
493	1.35E+05	1.45E+00	17.5	4	90	1
494	4.05E+01	2.33E+01	17.5	5	12	1
495	1.13E+03	6.23E+00	17.5	5	12	1
496	4.05E+01	6.99E+00	17.5	2	36	1
497	1.62E+04	5.59E-01	12.5	4	39	1
498	2.02E+03	2.91E+00	12.5	4	72	1
499	4.05E+01	5.18E+00	17.5	1	95	1
500	2.51E+05	1.49E-01	12.5	13	56	1
501	4.45E+02	2.44E+01	17.5	5	34	1
502	1.42E+04	5.11E-01	12.5	2	86	1
503	1.21E+04	2.98E-01	12.5	2	66	1
504	4.05E+03	4.44E-04	17.5	4	90	1
505	2.83E+02	8.53E-01	12.5	2	66	1
506	1.94E+04	1.40E-01	12.5	5	29	1
507	4.05E+03	2.80E+00	7.5	4	31	29
508	1.62E+02	8.42E+00	17.5	1	95	29
509	2.02E+01	1.78E-01	12.5	2	86	29
510	4.05E+01	3.22E+01	7.5	2	48	7
511	2.02E+01	3.95E-02	12.5	4	66	7
512	2.02E+01	8.95E+01	17.5	5	12	7
513	4.05E+03	1.96E+00	12.5	13	40	1
514	3.24E+02	2.80E-02	12.5	4	52	7
515	7.28E+02	9.32E-01	17.5	1	98	1
516	1.38E+03	5.26E-01	7.5	1	64	1
517	4.05E+03	3.69E-01	17.5	4	93	1
518	6.07E+03	1.88E+01	12.5	2	2	1
519	6.88E+02	3.29E-01	7.5	4	31	1
520	1.62E+04	3.02E-01	22.5	4	81	1
521	6.27E+03	3.61E+00	12.5	12	69	1
522	2.91E+03	3.26E+00	12.5	8	42	1
523	1.25E+05	3.19E-02	22.5	12	91	1
524	1.01E+04	1.23E-01	17.5	12	93	1
525	6.58E+03	9.11E-02	7.5	4	31	1
526	4.65E+03	2.98E-02	17.5	4	90	1
527	3.08E+03	2.21E+01	22.5	4	92	1
528	1.62E+04	-9.99E+02	7.5	1	62	1
529	2.43E+04	7.46E-01	7.5	2	32	1
530	2.83E+02	1.28E-01	12.5	2	56	1
531	4.45E+02	1.53E+00	17.5	5	53	1

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
532	9.11E+03	2.14E-01	22.5	4	92	1
533	8.73E+04	1.80E-03	12.5	2	45	1
534	2.19E+03	1.92E-03	7.5	2	48	1
535	2.27E+03	1.20E+00	17.5	4	69	1
536	4.52E+04	1.84E-07	7.5	1	64	1
537	1.42E+02	1.33E+01	12.5	2	45	1
538	6.21E+02	9.73E-01	7.5	2	48	1
539	5.06E+02	5.49E+01	12.5	2	66	1
540	4.11E+02	4.77E+00	7.5	1	62	1
541	1.01E+05	3.36E-02	17.5	4	69	1
542	4.86E+02	1.67E+02	7.5	2	48	1
543	4.05E+01	3.36E+01	12.5	4	66	1
544	2.37E+04	6.69E-01	7.5	1	44	1
545	6.75E+04	1.79E-01	22.5	4	92	1
546	9.31E+02	1.34E+00	12.5	8	46	1
547	6.07E+04	3.73E-01	22.5	12	91	1
548	4.05E+03	5.03E-02	17.5	5	90	1
549	4.05E+04	7.94E-02	12.5	5	40	1
550	1.86E+03	2.58E+00	12.5	8	82	1
551	7.28E+02	9.32E-01	17.5	1	98	1
552	1.62E+04	1.75E-01	17.5	4	90	1
553	5.58E+03	1.35E+00	12.5	5	40	1
554	1.89E+02	2.40E+01	7.5	13	48	1
555	2.02E+03	4.70E-01	22.5	4	96	1
556	8.09E+01	5.55E-02	12.5	5	33	30
557	2.02E+01	1.12E+00	17.5	5	12	30
558	2.02E+02	6.21E-02	17.5	1	79	30
559	2.02E+01	2.47E-03	12.5	4	72	30
560	2.02E+01	3.95E-02	7.5	8	49	4
561	2.83E+02	1.60E-01	7.5	2	32	4
562	4.05E+01	9.86E-03	22.5	4	81	4
563	2.06E+03	2.19E+00	22.5	4	92	4
564	4.45E+02	2.03E+00	17.5	12	95	4
565	9.31E+02	3.65E-01	17.5	12	95	4
566	2.02E+01	4.93E-02	7.5	8	32	4
567	4.05E+01	8.38E-02	7.5	5	3	4
568	2.02E+01	1.13E-01	12.5	2	66	4
569	2.35E+04	3.57E-02	17.5	5	12	4
570	2.02E+01	6.71E+00	12.5	12	42	4
571	2.39E+04	5.00E-01	17.5	13	56	4
572	1.21E+03	2.24E+01	17.5	12	89	4
573	1.29E+06	1.94E-08	22.5	2	21	4
574	1.52E+03	2.98E+00	12.5	2	40	4
575	2.02E+01	3.60E-01	12.5	5	40	4

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
576	4.17E+03	3.91E-01	22.5	13	30	4
577	8.09E+01	2.12E+00	7.5	2	45	4
578	2.02E+01	2.96E-02	12.5	2	86	4
579	4.25E+02	3.85E-01	17.5	13	90	4
580	1.01E+01	2.24E+00	12.5	8	42	4
581	2.02E+01	5.37E+01	17.5	5	12	4
582	9.31E+02	1.17E+01	12.5	4	74	1
583	8.09E+02	2.52E-01	17.5	1	69	1
584	1.01E+03	3.13E+00	12.5	1	31	1
585	2.23E+02	2.03E+00	12.5	12	45	1
586	7.28E+02	3.11E-02	17.5	12	95	1
587	1.38E+03	3.29E-01	12.5	5	40	1
588	2.31E+03	2.75E+00	17.5	12	93	1
589	2.02E+06	1.57E+00	22.5	5	22	1
590	1.38E+03	1.32E-01	7.5	1	65	1
591	7.61E+03	6.82E-01	12.5	5	69	1
592	2.02E+03	5.03E-02	12.5	13	40	1
593	7.28E+02	6.21E-01	12.5	4	45	1
594	1.74E+03	1.95E-01	17.5	5	90	1
595	3.44E+03	1.32E-01	12.5	8	9	1
596	8.09E+04	2.01E-02	12.5	5	26	1
597	2.57E+04	5.53E+00	22.5	2	22	1
598	8.90E+02	2.85E+00	17.5	2	74	1
599	8.94E+03	3.54E-01	12.5	1	31	1
600	8.38E+03	1.08E-02	17.5	4	93	1
601	3.43E+04	4.30E+00	17.5	4	22	1
602	2.43E+02	5.51E-02	7.5	2	45	1
603	4.86E+03	2.80E-01	12.5	12	72	1
604	1.01E+03	1.97E-01	12.5	2	71	1
605	2.31E+03	3.92E+00	12.5	8	9	1
606	4.05E+03	1.23E-05	12.5	5	40	1
607	5.26E+02	3.66E-01	17.5	4	90	1
608	2.02E+03	4.47E-01	12.5	13	20	1
609	3.56E+05	1.53E-01	17.5	13	90	1
610	4.05E+03	5.59E-02	17.5	4	23	1
611	5.06E+00	3.35E-01	12.5	12	42	1
612	8.50E+02	5.93E+00	12.5	8	46	1
613	4.45E+02	9.41E-03	12.5	12	48	1
614	2.02E+01	1.33E-01	12.5	2	66	1
615	9.31E+02	2.92E-02	17.5	5	53	30
616	2.02E+01	2.22E-01	12.5	2	88	30
617	2.02E+03	2.24E-01	7.5	4	83	30
618	4.65E+02	3.60E-01	17.5	13	53	30
619	2.02E+01	2.71E-02	12.5	8	53	30

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
620	2.02E+01	4.14E-01	12.5	12	72	30
621	6.75E+00	1.48E-01	22.5	4	96	30
622	2.43E+02	7.40E-03	17.5	5	53	11
623	3.04E+03	1.12E+00	12.5	12	49	11
624	4.05E+01	3.45E-02	7.5	12	48	11
625	2.02E+01	4.47E+01	22.5	4	96	11
626	6.88E+02	2.20E-01	17.5	4	30	11
627	2.02E+01	2.24E+00	12.5	5	40	11
628	1.01E+05	8.95E-04	7.5	5	10	11
629	5.26E+03	3.10E-01	22.5	5	92	11
630	6.07E+03	1.86E-03	17.5	2	90	11
631	2.02E+01	1.97E-02	7.5	12	48	11
632	9.31E+02	1.95E+00	12.5	13	74	1
633	4.86E+04	9.32E-02	22.5	11	94	1
634	5.67E+02	8.81E-05	12.5	2	88	1
635	2.02E+01	2.15E+01	17.5	4	77	1
636	3.72E+03	6.08E-03	17.5	12	95	1
637	4.05E+01	3.36E+01	7.5	12	48	1
638	4.45E+02	4.98E+00	17.5	4	90	1
639	1.21E+04	2.44E-01	7.5	12	48	1
640	1.86E+03	7.29E+00	12.5	12	42	1
641	1.62E+03	2.77E-03	17.5	1	79	1
642	3.64E+02	6.82E-02	12.5	9	51	1
643	2.59E+04	3.32E-01	22.5	13	92	1
644	3.24E+03	2.21E+00	12.5	12	48	1
645	8.09E+03	1.68E-03	22.5	12	76	1
646	1.21E+02	1.68E+00	12.5	12	69	24
647	4.05E+03	5.59E-02	12.5	2	86	2
648	2.02E+01	1.12E+00	12.5	8	46	2
649	5.67E+02	1.48E-01	12.5	2	53	2
650	2.43E+02	2.34E-02	7.5	5	3	2
651	4.05E+02	6.66E-03	22.5	4	96	2
652	8.09E+01	3.32E-01	17.5	5	13	1
653	2.02E+01	2.47E-02	12.5	1	71	1
654	2.02E+01	5.59E+00	12.5	4	88	1
655	1.13E+03	3.99E-01	17.5	13	20	1
656	4.45E+02	-9.99E+02	17.5	5	12	1
657	1.82E+03	5.74E-01	12.5	1	69	1
658	1.01E+01	4.44E-02	22.5	4	96	1
659	3.36E+03	3.37E-02	12.5	1	83	1
660	2.02E+01	4.44E-02	7.5	13	68	24
661	1.38E+03	2.96E-01	12.5	2	74	24
662	3.24E+03	3.48E-03	12.5	2	85	24
663	2.02E+03	3.58E-01	12.5	2	83	1

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
664	6.48E+02	1.47E-01	12.5	9	42	1
665	4.09E+03	1.66E-01	17.5	5	12	1
666	4.05E+04	4.47E-01	12.5	4	66	1
667	2.23E+02	1.52E-01	17.5	1	95	1
668	2.43E+02	1.19E-02	12.5	5	26	1
669	2.43E+02	3.73E+00	17.5	4	80	1
670	6.07E+03	2.42E-02	12.5	12	74	1
671	4.05E+01	2.68E+01	12.5	4	72	1
672	2.02E+02	8.88E-03	17.5	5	100	1
673	1.82E+02	7.46E+00	22.5	4	96	1
674	2.02E+03	1.13E-03	22.5	12	92	1
675	5.67E+02	3.20E+00	17.5	5	37	1
676	4.05E+03	1.80E-01	12.5	5	4	1
677	4.05E+01	3.23E+00	12.5	2	66	1
678	1.21E+02	6.71E-01	22.5	12	76	1
679	7.43E+03	1.68E-02	7.5	4	25	1
680	2.02E+01	8.38E-02	17.5	5	12	1
681	1.62E+02	1.68E-01	7.5	4	68	1
682	7.28E+02	1.55E-01	12.5	12	54	1
683	1.38E+03	3.26E-03	22.5	4	81	1
684	2.53E+02	3.91E-01	12.5	8	82	1
685	1.62E+04	3.50E-02	12.5	2	45	1
686	2.09E+04	3.03E-02	12.5	12	54	1
687	4.05E+01	5.18E-02	17.5	12	95	1
688	2.83E+02	2.51E+00	17.5	13	13	1
689	3.04E+03	7.40E-04	17.5	4	23	1
690	1.54E+04	4.12E-02	7.5	2	7	1
691	4.05E+02	1.12E+00	12.5	4	72	1
692	4.05E+03	7.22E-01	22.5	4	81	1
693	5.40E+02	1.12E+00	12.5	2	66	1
694	1.01E+04	1.58E-04	17.5	13	90	1
695	9.31E+02	9.73E-01	12.5	5	26	1
696	9.31E+02	2.07E-01	12.5	5	26	1
697	1.42E+02	9.59E-01	12.5	2	66	1
698	1.42E+02	1.60E-01	17.5	4	95	1
699	4.45E+02	1.02E+00	17.5	13	81	1
700	3.72E+03	1.02E-01	7.5	4	31	1
701	1.38E+03	1.69E-02	17.5	4	95	1
702	8.09E+04	3.36E-03	17.5	4	92	1
703	1.38E+03	4.13E-03	12.5	2	45	1
704	6.07E+02	4.44E-03	12.5	5	4	1
705	8.09E+01	6.71E-01	12.5	5	74	1
706	4.05E+01	1.23E-03	17.5	13	37	1
707	4.05E+01	2.07E-01	12.5	5	26	1
708	4.05E+03	7.84E-03	22.5	4	96	1

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
709	2.02E+04	4.47E-01	12.5	2	66	1
710	4.05E+01	1.12E+00	12.5	2	87	1
711	9.31E+02	9.73E-01	17.5	13	56	1
712	2.02E+03	8.88E-04	12.5	12	74	1
713	5.67E+02	6.39E+00	22.5	4	96	1
714	4.45E+02	2.03E-01	12.5	5	26	1
715	2.02E+01	2.46E+00	12.5	2	69	1
716	2.02E+03	4.47E-02	17.5	13	90	1
717	4.05E+01	2.24E-01	17.5	1	95	1
718	4.05E+01	1.23E-02	17.5	4	30	1
719	2.02E+03	8.95E-02	17.5	5	53	1
720	6.75E+00	1.12E+00	17.5	5	12	1
721	4.05E+03	4.47E-01	7.5	13	45	1
722	2.02E+01	8.88E-02	7.5	2	48	30
723	1.01E+01	1.97E-02	17.5	5	12	10
724	4.05E+01	8.39E+01	12.5	2	69	10
725	2.43E+02	-9.99E+02	12.5	4	63	10
726	2.02E+01	9.86E-03	17.5	5	12	10
727	2.02E+01	3.49E+01	12.5	4	56	10
728	2.02E+01	5.59E+00	7.5	13	45	10
729	2.02E+01	7.45E-01	17.5	5	12	10
730	2.83E+02	6.38E-02	12.5	12	54	1
731	2.02E+02	4.32E+01	17.5	1	89	1
732	8.09E+01	3.50E+00	12.5	12	51	1
733	9.31E+02	8.75E-01	12.5	4	51	1
734	5.06E+01	2.22E-02	12.5	4	45	1
735	8.50E+02	1.44E-01	12.5	4	72	1
736	4.05E+01	5.59E+01	22.5	5	92	31
737	2.02E+01	1.23E-01	22.5	4	92	31
738	2.02E+01	1.33E-01	17.5	2	36	31
739	2.02E+01	1.68E-01	17.5	4	34	31
740	2.02E+01	3.95E-02	17.5	5	21	31
741	1.21E+03	3.73E-02	7.5	1	64	7
742	2.02E+01	-9.99E+02	12.5	2	32	7
743	4.05E+01	1.68E+00	12.5	4	51	7
744	4.65E+02	5.93E-01	12.5	8	46	7
745	2.02E+01	9.86E-03	17.5	5	12	7
746	2.43E+02	1.16E-01	12.5	12	49	7
747	1.66E+03	6.82E-01	17.5	4	80	7
748	1.21E+03	1.49E+00	7.5	4	31	7
749	8.09E+01	5.60E-01	17.5	1	95	7
750	4.45E+02	2.75E+00	12.5	12	49	7
751	4.45E+02	1.64E-02	12.5	5	40	7
752	2.02E+01	8.88E-02	22.5	4	81	7

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
753	2.02E+01	2.24E+00	17.5	5	14	7
754	2.02E+03	1.16E+00	22.5	12	93	7
755	4.05E+01	4.02E-01	12.5	12	42	7
756	6.48E+02	4.89E+00	17.5	5	12	1
757	1.10E+02	8.68E-01	12.5	4	74	1
758	1.21E+03	2.49E-01	17.5	1	95	1
759	1.62E+02	6.04E+01	12.5	2	52	1
760	1.62E+02	1.51E+01	12.5	12	49	1
761	4.05E+01	1.40E+02	12.5	12	49	1
762	4.05E+01	1.40E+02	12.5	12	49	1
763	4.05E+03	2.10E-01	12.5	6	73	1
764	8.09E+01	6.71E-01	12.5	9	51	1
765	1.21E+02	4.25E+01	7.5	2	45	1
766	2.83E+02	1.28E+01	7.5	1	64	1
767	1.94E+04	7.50E+00	12.5	2	52	1
768	2.02E+03	1.72E+01	7.5	2	32	1
769	8.09E+02	1.34E+01	12.5	8	63	1
770	2.43E+02	1.98E+00	7.5	2	32	1
771	1.01E+02	4.47E+00	7.5	12	48	1
772	8.09E+01	7.05E-01	12.5	2	59	1
773	2.02E+01	2.22E-01	12.5	1	53	1
774	1.82E+02	1.53E+01	12.5	8	42	1
775	4.05E+01	5.67E-02	12.5	4	51	1
776	2.08E+03	6.52E-01	22.5	4	81	1
777	2.02E+01	8.88E-02	17.5	4	90	1
778	8.09E+01	2.24E+00	22.5	4	92	1
779	4.05E+01	2.91E-01	12.5	12	49	1
780	6.75E+01	4.47E+01	12.5	5	40	1
781	4.05E+01	4.24E+00	17.5	4	34	1
782	2.02E+02	2.58E-01	12.5	5	74	1
783	5.06E+00	8.38E-02	12.5	4	72	1
784	4.05E+01	2.80E+00	17.5	1	77	1
785	8.09E+01	5.55E-02	17.5	4	95	1
786	9.31E+02	3.16E-01	12.5	12	52	1
787	4.05E+01	5.60E-01	12.5	1	71	1
788	2.22E+04	4.49E-02	12.5	9	63	1
789	8.09E+01	2.52E-01	17.5	2	36	1
790	8.09E+01	1.99E+00	7.5	13	68	1
791	9.31E+02	4.38E-01	17.5	5	13	1
792	4.05E+01	2.46E+01	7.5	13	32	1
793	9.11E+04	3.69E-01	7.5	2	32	1
794	2.02E+01	3.95E-02	12.5	12	42	22
795	2.02E+01	6.90E-01	12.5	12	42	2
796	6.88E+02	5.53E-02	12.5	2	71	2

Table D.3 Nationwide Database of Waste Pile Sites

Site Number	Area (m²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
797	2.02E+01	2.68E+01	17.5	4	95	2
798	2.02E+01	3.36E+01	12.5	4	39	2
799	1.21E+02	7.46E-01	12.5	4	66	2
800	8.09E+01	7.64E-02	12.5	2	52	2
801	4.05E+01	7.89E-02	17.5	5	12	2
802	3.24E+02	3.50E+00	12.5	5	74	1
803	5.95E+03	2.71E-01	22.5	4	81	1
804	1.01E+01	1.04E-01	7.5	12	45	1
805	1.40E+06	8.41E-06	7.5	8	62	31
806	2.02E+01	4.44E-02	12.5	1	71	31
807	4.05E+01	1.01E-01	12.5	4	61	7
808	2.02E+03	4.44E-04	17.5	1	95	7
809	2.83E+02	3.20E+00	17.5	1	79	7
810	2.02E+01	5.57E-01	17.5	12	89	7
811	2.83E+02	8.00E-02	12.5	1	63	1
812	8.09E+01	4.70E+01	17.5	1	95	1
813	8.09E+01	6.29E-01	17.5	1	89	1
814	1.01E+04	1.18E-01	12.5	12	72	1
815	2.83E+02	2.21E-01	17.5	12	85	1
816	2.33E+03	1.94E-02	17.5	1	77	1
817	8.09E+01	5.55E-03	12.5	2	42	1
818	6.52E+03	2.92E-01	12.5	1	69	1
819	1.49E+04	8.53E-04	12.5	1	69	1
820	8.09E+01	3.08E-02	17.5	1	69	1
821	4.05E+01	1.23E-02	17.5	5	12	29
822	4.05E+03	-9.99E+02	7.5	1	31	3
823	2.02E+01	2.91E+00	7.5	12	48	3
824	2.02E+01	2.22E-01	22.5	12	58	3
825	4.05E+03	1.54E-01	12.5	2	85	1
826	2.02E+03	1.12E+00	7.5	8	62	1
827	2.29E+02	2.63E-01	12.5	2	66	1

Table D.4 Nationwide Database of Land Application Unit Sites

Site Number	Area (m ²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
1	4.05E+05	9.65E-01	12.5	1	2	1
2	2.43E+04	5.75E-05	12.5	2	2	30
3	4.45E+06	7.11E-01	12.5	2	2	1
4	1.01E+04	2.82E-02	12.5	5	2	1
5	4.05E+03	3.76E-02	7.5	2	3	1
6	6.07E+04	1.71E+00	7.5	5	3	24
7	4.86E+05	1.68E+00	12.5	1	5	1
8	2.02E+04	9.31E-02	7.5	1	7	10
9	4.05E+03	1.86E+00	7.5	1	7	1
10	2.10E+05	9.68E-03	7.5	1	7	11
11	1.01E+03	1.87E-03	7.5	4	7	1
12	2.02E+03	9.49E-02	12.5	1	8	30
13	6.48E+05	4.07E-01	12.5	1	8	11
14	1.94E+06	7.85E-01	12.5	8	9	1
15	1.05E+06	7.09E-01	12.5	8	9	1
16	9.31E+03	1.63E-02	17.5	5	13	1
17	4.05E+03	4.46E-03	17.5	5	13	1
18	8.09E+06	3.02E-04	17.5	5	13	30
19	5.58E+03	5.29E-03	17.5	5	13	30
20	4.05E+01	5.65E-01	17.5	5	13	30
21	6.07E+03	3.10E-01	17.5	5	13	11
22	6.07E+04	6.82E-01	17.5	5	13	11
23	4.05E+05	3.58E-01	17.5	5	13	11
24	1.01E+05	2.98E-01	17.5	5	13	1
25	4.05E+05	1.12E+00	17.5	5	13	1
26	1.21E+06	1.43E-01	17.5	5	13	1
27	1.26E+06	2.47E-01	17.5	5	13	1
28	3.24E+05	8.38E-02	17.5	5	13	1
29	4.05E+03	4.46E-03	17.5	5	15	30
30	5.10E+05	3.91E-01	12.5	4	20	1
31	1.21E+05	6.06E-01	17.5	5	20	1
32	4.05E+03	5.59E-02	22.5	5	21	11
33	9.31E+04	5.62E-01	17.5	4	23	1
34	6.48E+03	4.40E-02	17.5	4	23	1
35	1.21E+04	1.86E-02	17.5	5	23	1
36	1.09E+05	2.84E-01	17.5	5	23	1
37	4.05E+01	-9.99E+02	7.5	1	25	20
38	8.09E+07	1.12E-05	7.5	4	25	16
39	4.32E+04	-9.99E+02	7.5	4	25	1
40	1.27E+05	9.68E-03	12.5	2	29	1
41	2.83E+04	1.99E-03	12.5	7	29	1
42	1.90E+05	6.98E-01	17.5	2	30	1
43	4.61E+05	1.30E-04	17.5	4	30	1
44	9.71E+05	2.43E-02	17.5	4	30	1
45	6.68E+06	4.51E-01	17.5	4	30	1

Table D.4 Nationwide Database of Land Application Unit Sites

Site Number	Area (m ²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
46	5.71E+04	1.12E-02	7.5	2	31	1
47	8.50E+04	1.59E+00	7.5	2	31	30
48	1.62E+05	2.80E-03	7.5	2	31	30
49	2.43E+04	2.47E-05	7.5	2	31	30
50	1.17E+05	1.48E-03	7.5	4	31	30
51	4.05E+05	1.11E-03	12.5	8	31	1
52	3.74E+05	2.03E+00	12.5	8	31	1
53	4.45E+04	4.07E-03	7.5	2	32	9
54	2.43E+05	5.58E-01	7.5	2	32	1
55	2.43E+05	3.10E-01	7.5	8	32	11
56	3.24E+05	9.60E-01	7.5	8	32	1
57	1.72E+05	8.41E-05	7.5	8	32	1
58	1.90E+04	3.17E-03	12.5	2	33	1
59	6.48E+05	2.80E-03	12.5	5	33	1
60	8.46E+05	3.34E-03	17.5	2	34	1
61	2.36E+05	3.99E-03	17.5	2	34	1
62	3.24E+04	5.03E-03	22.5	4	35	1
63	2.79E+04	4.09E-02	22.5	4	35	1
64	1.42E+03	2.08E-02	22.5	4	35	1
65	8.50E+02	2.66E-01	22.5	4	35	1
66	2.10E+03	2.37E-06	17.5	5	37	3
67	6.48E+05	1.44E-01	12.5	2	39	2
68	1.13E+04	8.81E-08	7.5	1	40	1
69	1.21E+05	6.20E-02	7.5	12	41	11
70	4.05E+03	2.22E-04	12.5	2	42	1
71	3.44E+05	6.51E-04	12.5	12	42	1
72	4.05E+03	2.91E-03	12.5	12	42	1
73	8.09E+03	2.33E-03	12.5	12	42	1
74	1.78E+04	4.23E-03	12.5	12	42	1
75	2.02E+01	5.42E-02	12.5	12	42	30
76	4.45E+02	-9.99E+02	12.5	12	42	1
77	2.02E+05	1.33E-05	12.5	12	42	1
78	2.23E+06	3.72E-04	12.5	12	42	2
79	1.21E+04	7.46E-01	12.5	6	42	1
80	3.04E+05	4.53E-04	12.5	8	42	29
81	5.91E+04	-9.99E+02	12.5	8	42	1
82	1.70E+05	1.66E-02	12.5	8	42	30
83	9.31E+05	3.11E-03	12.5	8	42	1
84	5.74E+04	1.15E+00	12.5	9	42	1
85	2.02E+05	4.49E-05	12.5	9	42	1
86	2.43E+05	3.25E-05	12.5	9	42	24
87	4.17E+04	7.50E-02	12.5	9	42	2
88	1.01E+05	6.26E-04	7.5	2	45	11
89	1.34E+05	1.24E+00	7.5	2	45	1
90	9.31E+02	1.63E-01	12.5	8	46	1

Table D.4 Nationwide Database of Land Application Unit Sites

Site Number	Area (m ²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
91	4.65E+05	6.31E-01	12.5	8	46	11
92	4.45E+04	4.33E-03	12.5	8	46	1
93	2.43E+04	5.97E-02	12.5	8	46	1
94	2.02E+04	6.71E-01	12.5	1	100	22
95	1.21E+04	7.44E-01	7.5	2	48	30
96	3.84E+05	1.47E-01	7.5	2	48	11
97	6.31E+05	6.92E-02	7.5	2	48	11
98	3.35E+05	5.62E-03	7.5	2	48	1
99	1.74E+06	6.49E-01	7.5	2	48	1
100	3.24E+06	1.17E-02	7.5	4	48	1
101	3.71E+04	2.54E-04	7.5	12	48	1
102	4.86E+04	7.76E-03	7.5	12	48	11
103	2.71E+05	-9.99E+02	12.5	12	48	1
104	8.09E+03	2.17E-03	12.5	12	49	1
105	9.11E+05	4.08E-04	12.5	12	49	30
106	9.71E+04	1.05E-03	12.5	12	49	1
107	5.67E+05	3.09E-01	7.5	2	50	30
108	3.76E+05	1.85E-01	7.5	2	50	11
109	5.91E+04	1.24E-03	12.5	2	50	1
110	2.68E+05	4.92E-03	12.5	12	50	1
111	8.09E+05	2.24E-03	12.5	12	50	1
112	9.11E+05	5.17E-03	12.5	2	51	30
113	1.82E+05	4.55E-02	12.5	4	51	11
114	2.02E+06	6.90E-01	12.5	4	51	1
115	7.57E+05	5.44E-03	12.5	12	51	1
116	3.69E+05	3.20E-04	12.5	9	51	1
117	2.79E+03	3.57E-05	12.5	2	52	3
118	2.02E+01	1.88E+00	12.5	2	52	30
119	2.02E+04	1.07E-02	12.5	4	52	3
120	2.02E+04	2.03E-01	12.5	4	52	1
121	8.78E+05	3.90E-03	12.5	12	52	11
122	2.23E+04	1.01E-03	7.5	12	53	11
123	7.59E+04	7.89E-05	17.5	5	53	1
124	1.01E+06	2.68E-05	17.5	5	53	30
125	2.02E+06	2.13E-03	17.5	5	53	11
126	2.63E+04	5.31E-05	12.5	12	54	1
127	3.72E+03	9.25E-03	12.5	12	54	1
128	8.09E+04	1.40E-04	12.5	12	54	30
129	1.01E+05	4.47E-02	12.5	12	54	1
130	4.05E+04	7.52E-02	12.5	12	54	1
131	2.43E+06	1.45E-04	12.5	4	55	1
132	1.01E+05	6.02E-04	12.5	4	55	1
133	2.02E+04	2.33E-03	12.5	2	56	2
134	8.09E+05	3.50E-04	12.5	5	56	1
135	1.09E+05	1.76E-03	22.5	12	57	1

Table D.4 Nationwide Database of Land Application Unit Sites

Site Number	Area (m ²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
136	4.05E+01	5.57E-01	17.5	2	58	1
137	3.64E+06	1.02E+00	17.5	2	58	1
138	1.62E+04	2.02E-03	22.5	2	58	9
139	1.21E+04	-9.99E+02	22.5	4	58	1
140	8.09E+03	6.71E-02	12.5	1	63	1
141	1.01E+06	2.68E-03	12.5	5	64	1
142	1.62E+05	5.03E-04	12.5	5	64	1
143	2.43E+04	2.05E-07	12.5	5	64	1
144	3.24E+03	2.80E-03	12.5	4	66	11
145	1.28E+06	2.45E-03	12.5	4	66	1
146	9.31E+02	9.72E-02	7.5	4	68	1
147	4.05E+04	9.31E-03	7.5	4	68	30
148	4.05E+04	2.24E-03	12.5	1	69	1
149	4.05E+04	4.02E-04	12.5	1	69	1
150	1.21E+04	2.33E-03	12.5	1	69	1
151	3.22E+04	4.70E-01	12.5	12	69	1
152	4.05E+04	9.31E-04	12.5	12	69	16
153	1.01E+04	8.93E-02	12.5	12	69	11
154	8.09E+05	1.90E-03	12.5	12	69	1
155	2.10E+03	9.68E-02	12.5	12	69	24
156	2.02E+05	6.83E-01	12.5	5	69	1
157	9.15E+05	8.24E-04	17.5	1	69	1
158	2.83E+04	6.71E-03	17.5	1	69	1
159	1.30E+05	7.30E-02	17.5	1	69	1
160	8.09E+04	3.48E-04	17.5	1	69	2
161	4.05E+04	2.79E-01	17.5	1	69	1
162	1.54E+05	1.71E-01	17.5	1	69	1
163	1.01E+05	2.66E-05	17.5	4	69	1
164	1.21E+05	6.86E-01	12.5	1	71	1
165	1.01E+05	7.52E-03	12.5	1	71	1
166	2.19E+05	6.89E-03	12.5	1	71	1
167	2.02E+04	3.35E-03	12.5	2	71	1
168	1.21E+03	7.40E-04	12.5	2	71	30
169	1.32E+05	4.29E-01	12.5	2	71	11
170	1.19E+05	2.47E-09	12.5	12	71	1
171	2.43E+05	7.44E-05	12.5	1	72	30
172	1.54E+05	2.33E-01	12.5	1	72	1
173	5.67E+02	3.17E-03	12.5	4	72	1
174	4.05E+03	4.50E-04	12.5	4	72	1
175	9.31E+02	-9.99E+02	12.5	4	72	1
176	2.91E+05	6.46E-01	12.5	4	72	1
177	8.09E+01	-9.99E+02	12.5	4	72	2
178	1.62E+05	3.08E-08	17.5	4	72	1
179	2.79E+03	2.70E-01	12.5	4	73	1
180	7.28E+05	2.17E-01	12.5	6	73	1

Table D.4 Nationwide Database of Land Application Unit Sites

Site Number	Area (m ²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
181	8.09E+03	4.89E-03	12.5	6	73	1
182	9.31E+02	1.98E-01	12.5	9	73	1
183	2.02E+04	2.47E-05	12.5	2	74	30
184	1.42E+05	3.52E-08	12.5	12	74	30
185	4.05E+05	9.31E-02	12.5	12	74	11
186	4.05E+04	6.15E-03	17.5	2	74	1
187	4.09E+04	6.09E-03	17.5	2	74	1
188	8.09E+03	4.93E-05	17.5	2	74	10
189	2.83E+05	2.24E-03	17.5	4	74	1
190	1.21E+05	1.15E-05	17.5	12	74	16
191	8.63E+05	1.25E-03	17.5	12	74	2
192	3.28E+04	1.16E-01	17.5	5	74	1
193	1.21E+04	1.56E-04	22.5	12	76	1
194	4.61E+05	2.19E+00	22.5	12	76	1
195	1.52E+05	-9.99E+02	22.5	12	76	1
196	4.90E+05	1.04E-01	22.5	12	76	1
197	4.05E+05	2.21E-03	22.5	12	76	1
198	2.02E+01	3.45E-02	17.5	1	77	30
199	6.03E+04	4.20E-02	17.5	1	77	11
200	6.07E+04	1.86E-03	17.5	1	77	11
201	3.34E+05	5.63E-03	17.5	1	77	1
202	1.62E+04	2.33E-01	17.5	1	77	1
203	1.34E+05	1.76E+00	17.5	1	77	1
204	4.05E+06	1.40E-03	17.5	1	77	1
205	1.62E+05	1.16E+00	17.5	2	77	1
206	1.94E+05	2.04E-01	17.5	2	77	1
207	6.07E+04	7.75E-02	17.5	4	77	1
208	2.70E+05	9.25E-06	17.5	4	77	16
209	8.09E+05	3.65E-03	17.5	4	77	1
210	2.51E+03	-9.99E+02	22.5	12	78	3
211	1.51E+06	-9.99E+02	22.5	12	78	1
212	1.21E+03	1.57E-02	22.5	12	78	2
213	3.52E+05	-9.99E+02	22.5	10	78	1
214	8.09E+03	-9.99E+02	17.5	1	79	1
215	6.07E+03	3.38E-02	17.5	1	79	9
216	6.75E+05	9.68E-04	17.5	1	79	30
217	5.26E+04	1.18E+00	17.5	1	79	1
218	6.07E+04	6.04E-01	17.5	1	79	1
219	1.62E+04	2.26E-03	17.5	1	79	1
220	4.05E+03	6.71E-03	17.5	1	79	31
221	9.31E+03	6.07E-03	17.5	1	79	7
222	7.42E+03	6.84E-01	17.5	1	79	1
223	6.48E+03	5.82E-02	17.5	1	79	1
224	8.09E+04	6.98E-02	17.5	1	79	1
225	2.02E+05	3.35E-04	17.5	4	79	1

Table D.4 Nationwide Database of Land Application Unit Sites

Site Number	Area (m ²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
226	1.65E+06	3.56E-03	17.5	4	79	1
227	2.02E+05	1.12E-03	17.5	4	79	1
228	4.61E+05	1.28E-02	17.5	2	80	1
229	2.18E+04	-9.99E+02	17.5	4	80	1
230	4.73E+03	2.71E-02	17.5	4	80	1
231	4.05E+04	1.84E-02	17.5	4	80	1
232	3.24E+02	1.54E-05	22.5	4	81	1
233	5.67E+02	1.76E-04	22.5	4	81	1
234	1.74E+03	1.52E-01	22.5	4	81	1
235	2.43E+04	1.12E-02	22.5	4	81	1
236	5.26E+04	5.01E-01	22.5	4	81	1
237	3.24E+05	1.23E-02	22.5	4	81	1
238	1.34E+05	5.64E-02	22.5	4	81	2
239	1.34E+04	3.74E-07	22.5	4	81	1
240	4.05E+03	9.76E-03	22.5	4	81	1
241	1.62E+04	7.05E-01	22.5	4	81	1
242	1.82E+06	4.59E-03	22.5	4	81	1
243	4.05E+04	3.87E-01	22.5	4	81	2
244	7.28E+05	1.62E-02	22.5	4	81	1
245	2.43E+04	1.54E-02	22.5	4	81	1
246	1.62E+04	1.86E-01	22.5	4	81	1
247	2.43E+04	1.12E-02	22.5	4	81	1
248	9.71E+04	3.89E-03	22.5	4	81	1
249	2.83E+04	7.31E-03	12.5	1	83	1
250	1.62E+04	1.40E-01	7.5	1	84	30
251	1.62E+05	1.12E-03	17.5	12	85	1
252	4.05E+04	1.11E-04	12.5	2	88	30
253	5.67E+03	1.66E-01	12.5	2	88	11
254	2.43E+05	1.21E-01	12.5	2	88	1
255	5.67E+04	4.56E-03	17.5	12	89	1
256	6.88E+05	6.58E-04	17.5	12	89	1
257	4.05E+04	2.09E-02	17.5	12	89	1
258	2.43E+05	7.44E-05	17.5	12	89	2
259	4.05E+02	1.88E-01	17.5	12	89	2
260	2.02E+04	5.10E-03	17.5	12	89	1
261	4.05E+01	2.22E-02	17.5	4	90	30
262	5.26E+04	8.54E-05	17.5	5	90	1
263	2.02E+06	8.95E-04	17.5	5	90	7
264	2.02E+05	5.21E-03	17.5	5	90	30
265	2.02E+04	2.17E-02	17.5	5	90	1
266	6.48E+04	9.07E-01	22.5	12	91	1
267	1.21E+06	6.20E-01	22.5	12	91	1
268	1.54E+05	9.74E-01	22.5	12	91	1
269	3.24E+05	1.01E+00	22.5	12	91	1
270	1.21E+05	1.49E-04	22.5	10	91	1

Table D.4 Nationwide Database of Land Application Unit Sites

Site Number	Area (m ²)	Depth (m)	Soil/GW Temperature (° C)	HG Environment	Nearest Climate Center	Site Weighting
271	2.63E+03	1.72E-02	17.5	4	92	1
272	7.45E+03	5.11E-01	22.5	4	92	1
273	8.09E+03	3.38E-01	22.5	4	92	2
274	2.79E+04	3.87E-02	22.5	4	92	1
275	4.05E+04	2.51E-03	22.5	4	92	1
276	6.07E+05	5.97E-03	22.5	4	92	7
277	5.58E+05	7.97E-04	22.5	4	92	1
278	5.26E+05	2.68E-02	22.5	5	92	1
279	2.83E+04	1.60E-03	17.5	1	93	1
280	2.02E+06	4.47E-03	17.5	1	93	1
281	3.04E+06	1.49E-05	17.5	1	93	1
282	1.05E+04	5.31E-03	17.5	4	93	1
283	5.34E+05	-9.99E+02	17.5	4	93	1
284	4.05E+05	-9.99E+02	17.5	4	93	1
285	4.65E+05	3.84E-02	17.5	4	93	1
286	1.21E+05	3.10E-02	17.5	4	93	1
287	2.02E+04	1.13E-01	17.5	4	93	1
288	8.22E+05	2.40E-04	17.5	4	93	1
289	5.67E+04	1.13E-01	17.5	12	93	1
290	1.62E+05	2.02E-04	17.5	12	93	1
291	3.24E+03	1.54E-06	22.5	12	93	7
292	2.02E+04	3.00E-02	22.5	10	94	1
293	2.02E+04	2.42E-02	17.5	1	95	1
294	9.31E+04	9.47E-01	17.5	1	95	1
295	2.16E+02	9.40E-01	17.5	1	95	1
296	1.21E+05	7.13E-01	17.5	1	95	7
297	1.62E+04	2.01E-02	17.5	1	95	7
298	2.02E+06	1.79E-03	17.5	4	95	1
299	3.64E+05	4.14E-02	17.5	12	95	1
300	4.05E+05	7.46E-05	17.5	12	95	1
301	1.42E+05	1.46E-03	17.5	12	95	1
302	8.09E+03	1.68E-02	22.5	4	96	3
303	2.51E+04	3.30E-02	22.5	4	96	1
304	8.09E+03	9.40E-02	22.5	4	96	1
305	4.05E+03	9.04E-01	22.5	4	96	9
306	1.62E+04	1.85E-05	22.5	4	96	30
307	4.86E+04	-9.99E+02	22.5	4	96	11
308	2.69E+05	8.71E-04	22.5	4	96	1
309	2.89E+05	1.30E-02	22.5	4	96	1
310	1.01E+03	3.58E-02	22.5	4	96	1
311	2.23E+05	1.65E-03	22.5	4	96	1

Table D.5 Hydrogeologic Database for HG Environment 1

Subsurface Environment Description			
Metamorphic and Igneous			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
-999	2.59E+01	-999	1.66E-02
3.15E+00	1.68E+01	1.52E+02	-999
-999	1.52E+01	1.52E+01	-999
-999	6.10E+02	-999	1.00E-04
-999	5.79E+00	9.14E+00	5.00E-02
9.46E+02	4.57E+00	-999	1.40E-02
1.58E+03	3.05E+00	-999	1.40E-02
6.31E+01	4.88E+00	1.22E+01	7.00E-02
3.47E+03	6.10E+00	1.52E+02	3.00E-02
2.84E+01	2.04E+00	9.14E+00	1.00E-02
1.26E+02	6.10E+00	7.32E+00	3.00E-02
1.58E+01	3.81E+00	3.29E+01	9.00E-02
3.15E+02	2.13E+01	3.05E+00	-999
-999	6.10E+00	6.10E+00	7.00E-06
1.10E+04	3.05E+00	1.83E+01	2.00E-02
9.46E+01	1.83E+00	4.27E+00	4.00E-02
-999	1.22E+00	9.14E+00	1.00E-02
7.57E+03	1.52E+00	3.05E+00	7.00E-06
6.31E+00	9.14E-01	6.10E+00	3.80E-02
6.31E+00	1.83E+00	7.62E+00	1.00E-01
3.15E+01	6.10E+00	-999	6.00E-02
3.15E+01	3.05E-01	6.10E+00	5.00E-03
-999	9.14E+00	1.52E+02	8.00E-03

Note: -999 indicates a missing sample value.

Table D.6 Hydrogeologic Statistics for HG Environment 1

Subsurface Environment Statistics			
Metamorphic and Igneous			
Mean Values			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
-8.52129	2.81441	3.76962	-3.97399
Covariance Matrix			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
6.82319			
1.07478	0.8005		
1.80348	0.55257	1.1956	
-0.39418	0.4367	0.17788	0.81424

Table D.7 Hydrogeologic Database for HG Environment 2

Subsurface Environment Description			
Bedded Sedimentary Rock			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
6.31E+01	6.10E+00	2.29E+01	8.00E-02
2.84E+01	6.10E+00	7.93E+01	-999
1.89E+03	7.65E+01	-999	8.00E-03
5.99E+03	3.05E+01	1.83E+02	1.00E-03
3.15E+02	6.55E+01	4.57E+01	5.70E-03
3.15E+01	1.52E+01	2.13E+01	1.00E-01
1.58E+03	1.74E+02	3.05E+01	-999
3.15E+02	5.97E+00	3.60E+00	-999
2.21E+01	1.22E+01	1.07E+01	2.80E-02
2.84E+02	1.68E+01	3.05E+00	3.20E-03
9.46E+00	6.10E+00	1.52E+02	3.10E-02
2.21E+02	9.14E+00	-999	8.00E-03
3.15E+00	3.96E+00	4.57E+00	1.00E-02
3.15E+00	4.57E+00	9.14E+01	1.00E-03
2.21E+03	1.52E+01	3.05E+01	3.30E-02

Table D.7 Hydrogeologic Database for HG Environment 2

Subsurface Environment Description			
Bedded Sedimentary Rock			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
1.10E+04	1.83E+01	9.14E+01	-999
1.26E+02	1.34E+01	7.62E+00	4.00E-03
1.33E+03	6.10E+00	2.13E+01	5.00E-03
3.15E+04	1.83E+00	3.05E+00	-999
-999	4.27E+00	8.90E+01	-999
1.89E+03	5.36E+01	6.10E+00	4.30E-02
9.78E+03	1.83E+01	3.05E+01	1.20E-02
6.31E+00	1.22E+01	2.44E+01	1.50E-02
3.15E+00	1.22E+01	1.22E+01	2.50E-02
1.26E+01	3.70E+00	3.00E+01	1.00E-02
2.21E+07	9.14E+00	1.52E+00	1.00E+00
3.47E+04	1.22E+01	4.57E+00	8.00E-03
3.15E+04	1.52E+01	6.10E+00	5.00E-02
3.15E+00	3.66E+00	9.14E+00	4.00E-02
3.15E+02	9.14E+00	2.13E+01	5.00E-03
3.15E+02	8.53E+00	1.90E+01	2.50E-02
-999	4.88E+00	-999	-999
-999	3.05E+00	-999	2.40E-02
6.31E+01	4.57E+00	1.98E+01	4.00E-02
1.89E+02	6.10E+00	6.10E+01	2.30E-02
2.21E+07	4.57E+00	1.83E+00	1.00E+00
-999	1.83E+02	1.22E+01	4.00E-04
2.21E+01	2.74E+00	3.05E+00	-999
1.89E+02	1.52E+01	6.10E+01	1.20E-02
1.10E+04	1.52E+01	2.29E+01	5.00E-04
-999	3.66E+00	1.83E+01	-999
6.31E+01	8.23E+00	5.18E+02	7.00E-03
1.26E+02	4.57E+00	1.07E+02	3.00E-02
-999	1.52E+00	9.14E+01	-999

Note: -999 indicates a missing sample value.

Table D.8 Hydrogeologic Statistics for HG Environment 2

Subsurface Environment Statistics				
Bedded Sedimentary Rock				
Mean Values				
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)	
-7.68877	3.4698	4.2618	-4.42479	
Covariance Matrix				
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)	
12.3279				
Unsaturated Zone Thickness In(ft)	1.32509	0.54208		
Saturated Zone Thickness In(ft)	0.47331	-0.01357	1.61831	
Regional Hydraulic Gradient In(ft/ft)	-1.46902	-0.1757	-0.39626	1.75145

Table D.9 Hydrogeologic Database for HG Environment 3

Subsurface Environment Description			
Bedded Sedimentary Rock			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
2.55E+04	3.66E+00	3.66E+00	9.00E-04
9.46E+02	9.14E+00	5.33E+00	5.00E-03
1.26E+03	1.77E+00	6.10E+00	4.00E-09
2.84E+01	6.10E+00	-999	3.40E-02
3.78E+03	1.68E+01	1.52E+00	4.00E-02
2.68E+03	6.71E+00	2.44E+00	9.00E-03
3.15E+01	9.45E+00	-999	5.00E-02
-999	7.62E+00	-999	1.00E-02
6.31E+01	2.30E+00	4.12E+00	7.00E-03
6.62E+03	3.05E+01	2.13E+01	2.00E-02
1.26E+02	3.06E+00	1.52E+01	1.00E-02
3.15E+01	-999	-999	1.00E-02
8.83E+03	5.33E+00	4.57E+01	5.00E-04
1.58E+02	9.14E-01	4.57E+00	3.00E-03
6.31E+00	1.37E+00	3.66E+00	2.70E-02
9.46E+00	2.56E+00	2.74E+00	4.20E-02

Note: -999 indicates a missing sample value.

Table D.10 Hydrogeologic Statistics for HG Environment 3

Subsurface Environment Statistics				
Bedded Sedimentary Rock				
Mean Values				
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)	
-7.81342	2.72776	2.93298	-4.6888	
Covariance Matrix				
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)	
Hydraulic Conductivity In(cm/s)				
21.2765				
Unsaturated Zone Thickness In(ft)	2.78074	1.07038		
Saturated Zone Thickness In(ft)	0.6463	0.17468	0.96341	
Regional Hydraulic Gradient In(ft/ft)	-1.30916	0.29718	-0.64536	1.9708

Table D.11 Hydrogeologic Database for HG Environment 4

Subsurface Environment Description			
Sand and Gravel			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
5.08E+04	4.57E+00	9.14E+00	5.00E-03
1.39E+04	-999	3.35E+01	2.80E-02
-999	6.10E+00	-999	-999
-999	1.22E+01	4.57E+00	1.00E-02
1.58E+03	2.13E+00	1.22E+01	1.00E-03
3.15E+00	1.98E+01	2.44E+00	7.00E-03
1.26E+01	4.57E+00	1.07E+01	7.00E-02
-999	9.14E-01	6.10E+00	4.30E-02
2.52E+03	1.52E+00	3.05E+00	2.00E-02
3.15E+03	2.44E+00	-999	2.00E-06
9.46E+00	1.83E+00	6.04E+00	5.50E-02
9.46E+01	6.10E-01	3.96E+00	6.00E-03
-999	6.98E+00	5.33E+01	-999
1.16E+05	1.52E+01	7.62E+01	4.00E-03
1.26E+04	7.62E+00	6.40E+00	4.90E-02

Table D.11 Hydrogeologic Database for HG Environment 4

Subsurface Environment Description			
Sand and Gravel			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
4.10E+03	2.13E+00	3.20E+01	3.00E-03
-999	1.07E+01	8.53E+00	6.00E-04
-999	6.10E-01	7.62E+00	1.00E-03
3.15E+03	3.05E-01	9.14E+00	3.00E-03
2.21E+02	1.52E+00	7.62E+00	4.00E-03
-999	4.57E+00	2.74E+01	1.50E-02
3.15E+00	3.05E+00	3.05E+00	2.00E-02
6.31E+02	2.44E+00	7.62E+00	5.00E-03
-999	5.08E+01	1.45E+02	9.20E-02
-999	1.52E+01	6.10E+00	1.00E-07
3.15E+01	3.35E+01	-999	2.30E-02
3.15E+02	9.14E+00	3.05E+00	2.00E-03
4.42E+03	1.52E+00	1.98E+01	2.00E-03
6.31E+02	2.21E+00	3.32E-01	1.00E-03
-999	1.22E+00	-999	-999
-999	9.14E+00	3.05E+00	5.00E-03
7.88E+03	2.29E+01	3.05E+00	2.00E-02
5.36E+03	3.05E+00	6.10E+00	1.00E-03

Note: -999 indicates a missing sample value.

Table D.12 Hydrogeologic Statistics for HG Environment 4

Subsurface Environment Statistics				
Sand and Gravel				
Mean Values				
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)	
-6.82634	2.65875	3.3063	-4.9212	
Covariance Matrix				
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)	
9.60704				
0.51036	1.5223			
1.46619	-0.01024	1.28413		
-1.4956	0.0939	-0.02391	1.83998	

Table D.13 Hydrogeologic Database for HG Environment 5

Subsurface Environment Description			
Alluvial Basins Valleys & Fans			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
5.68E+03	3.05E+00	2.13E+01	2.00E-03
-999	9.14E-01	3.96E+00	-999
9.46E+02	-999	1.52E+01	9.30E-02
-999	3.05E+00	6.10E+00	1.00E-02
1.58E+05	6.10E+00	3.05E+00	1.00E-04
6.31E+04	5.18E+00	1.52E+00	5.00E-03
-999	6.10E+00	3.05E+00	5.00E-03
1.56E+01	3.81E+01	1.52E+00	2.50E-02
1.26E+05	4.57E+00	4.57E+00	1.00E-03
-999	4.57E+00	2.29E+01	3.00E-02
7.57E+03	3.05E+01	-999	-999
-999	1.01E+02	1.52E+01	5.00E-02
1.58E+03	3.35E+01	9.14E+02	1.00E-03
3.15E+04	3.05E+01	2.44E+01	1.00E-03
-999	9.75E+00	1.52E+01	-999
6.31E+00	3.38E+00	7.62E+00	3.00E-03
-999	3.29E+01	4.57E+00	-999

Table D.13 Hydrogeologic Database for HG Environment 5

Subsurface Environment Description			
Alluvial Basins Valleys & Fans			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
2.37E+04	4.27E+01	6.10E+00	3.00E-03
-999	1.07E+01	1.07E+00	-999
1.58E+03	1.98E+01	2.44E+01	5.00E-03
1.26E+03	2.44E+00	-999	-999
3.15E+03	1.22E+01	3.81E+00	-999
1.26E+02	1.52E+01	4.57E+00	2.00E-03
9.46E+02	3.05E+00	3.05E+00	2.00E-03
-999	4.57E+00	-999	-999
-999	2.44E+00	-999	-999
1.39E+03	3.41E+01	9.14E+01	3.00E-03
-999	1.22E+01	8.53E+01	-999
-999	3.66E+00	-999	-999
-999	2.74E+01	-999	6.00E-03
-999	1.59E+01	1.62E+01	4.00E-04
9.46E+01	7.01E+00	9.14E+00	3.00E-04
2.84E+03	4.27E+01	3.05E+01	2.00E-03
1.58E+02	1.30E+01	1.30E+02	1.00E-03
-999	1.83E+01	3.66E+00	1.00E-02
1.26E+03	7.32E+00	1.83E+01	1.00E-04
6.31E+01	8.23E+01	-999	-999
1.58E+04	3.66E+01	-999	1.00E-03
3.47E+03	7.62E+00	1.52E+01	2.00E-02
-999	1.22E+01	1.52E+01	1.00E-03
1.26E+02	1.83E+00	1.10E+01	2.00E-03
2.21E+03	1.52E+01	9.14E+00	-999
3.15E+00	3.66E+00	2.44E+00	5.00E-03
-999	1.22E+01	4.88E+01	1.00E-02
-999	3.66E+01	-999	6.80E-02
6.37E+04	6.10E+01	-999	-999
3.15E+00	6.10E+01	1.52E+01	1.50E-02
-999	7.01E+00	1.83E+01	-999
6.31E+02	1.46E+01	2.44E+01	3.00E-03
3.19E+06	9.14E+00	3.05E-01	2.00E-06
3.15E+03	1.07E+01	3.05E+00	6.00E-03
3.15E+00	4.72E+00	1.83E+01	7.00E-02
9.46E+02	1.37E+01	6.10E+00	8.00E-03
3.15E+03	7.62E+00	7.62E+00	-999
3.15E+02	4.88E+00	9.14E+00	1.70E-02
1.10E+04	2.44E+00	6.10E+00	-999
-999	2.44E+00	5.18E+00	4.00E-02
-999	3.96E+00	1.83E+01	-999
1.26E+01	2.13E+00	6.10E-01	-999

Table D.13 Hydrogeologic Database for HG Environment 5

Subsurface Environment Description			
Alluvial Basins Valleys & Fans			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
2.21E+03	9.14E+00	1.52E+00	2.50E-02
-999	3.05E+00	6.10E+00	1.30E-02
2.21E+04	6.10E+00	9.14E+01	1.00E-03

Note: -999 indicates a missing sample value.

Table D.14 Hydrogeologic Statistics for HG Environment 5

Subsurface Environment Statistics				
Alluvial Basins Valleys & Fans				
Mean Values				
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)	
-5.61434	3.43835	3.53678	-5.61773	
Covariance Matrix				
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)	
Hydraulic Conductivity In(cm/s)				
Unsaturated Zone Thickness In(ft)	0.28014	0.8396		
Saturated Zone Thickness In(ft)	0.08839	0.54136	2.05569	
Regional Hydraulic Gradient In(ft/ft)	2.96927	0.0448	-0.71488	4.17328

Table D.15 Hydrogeologic Database for HG Environment 6

Subsurface Environment Description			
River Valleys and Flood Plains with overbank deposits			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
-999	1.52E+01	1.83E+01	5.00E-03
-999	1.83E+00	9.14E+00	2.00E-03
3.15E+02	4.88E+00	1.52E+01	1.00E-03
6.31E+02	8.53E+00	9.14E+00	1.00E-02
1.07E+05	3.51E+00	7.32E+00	5.00E-03
1.89E+03	2.44E+01	3.66E+01	1.00E-03
3.15E+00	2.74E+00	3.66E+00	3.00E-03
-999	2.13E+01	7.62E+00	1.00E-03
4.10E+03	2.74E+01	3.05E+00	1.00E-03
1.67E+04	2.44E+00	6.40E+00	4.00E-03
1.10E+04	5.49E+00	1.31E+01	2.00E-03
3.15E+02	1.52E+00	3.05E+00	2.00E-03
-999	1.22E+00	1.83E+00	8.00E-03
1.10E+04	5.79E+00	-999	5.00E-04
-999	3.96E+00	4.27E+00	1.70E-02
-999	1.22E+01	1.68E+01	2.00E-03
1.58E+03	4.57E+00	7.62E+00	4.00E-02
3.31E+04	3.05E+01	2.29E+01	1.00E-02
-999	4.57E+00	7.62E+00	1.00E-01
2.52E+02	1.15E+01	-999	5.00E-03
1.42E+04	4.57E+00	1.83E+01	7.00E-04
3.15E+03	1.52E+00	1.52E+00	4.00E-07
5.68E+03	3.05E+00	6.10E+00	1.00E-03
1.89E+03	3.66E+00	6.10E+00	2.00E-03
3.15E+02	3.66E+00	6.10E-01	1.00E-06
3.15E+01	1.52E+00	-999	2.00E-08
3.15E+03	1.19E+00	3.66E+00	-999
1.55E+04	5.18E+00	7.93E+00	6.00E-03
5.52E+03	3.66E+00	5.49E+00	1.00E-02
3.15E+03	3.05E+00	1.68E+01	1.30E-02
1.58E+02	1.52E+00	3.05E+00	1.20E-02
2.21E+01	1.22E+00	1.37E+01	4.00E-03
-999	1.83E+00	9.14E+00	1.10E-02
9.46E+00	9.14E-01	6.10E+00	8.00E-03
-999	1.07E+01	1.52E+01	8.00E-05
-999	1.22E+01	1.22E+01	1.00E-06

Note: -999 indicates a missing sample value.

Table D.16 Hydrogeologic Statistics for HG Environment 6

Subsurface Environment Statistics			
River Valleys and Flood Plains with overbank deposits			
Mean Values			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
-6.7624	2.65846	3.15814	-5.6184
Covariance Matrix			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
13.8058			
1.67704	0.8987		
2.14642	0.34951	0.86919	
-0.09303	-0.23716	0.00252	1.23921

Table D.17 Hydrogeologic Database for HG Environment 7

Subsurface Environment Description			
River Valleys and Flood Plains without overbank deposits			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
9.46E+02	2.44E+00	8.23E+00	2.00E-03
1.26E+03	2.13E+00	3.05E+02	3.00E-03
-999	3.54E+01	-999	-999
6.94E+03	-999	2.29E+01	3.00E-03
2.33E+04	1.52E+01	3.66E+01	4.00E-03
4.42E+03	1.83E+00	3.81E+01	7.00E-04
5.61E+04	3.05E+00	1.01E+01	2.00E-03
5.52E+04	3.05E+00	6.10E+01	-999
9.46E+03	5.79E+01	9.14E+00	1.00E-06
-999	9.14E+00	9.14E+00	2.00E-04
-999	1.22E+01	9.14E+00	2.00E-03
9.46E+02	3.05E+00	3.05E+00	8.00E-03
9.78E+03	3.05E+00	3.05E+00	1.30E-02
-999	5.18E+00	1.22E+01	2.00E-03
4.42E+03	3.66E+00	1.52E+01	5.00E-03
4.42E+03	2.44E+01	2.13E+01	1.00E-02

Table D.17 Hydrogeologic Database for HG Environment 7

Subsurface Environment Description			
River Valleys and Flood Plains without overbank deposits			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
1.58E+03	1.52E+00	2.44E+01	1.00E-02
8.20E+04	1.49E+01	8.53E+00	3.00E-03
9.46E+02	1.22E+01	1.83E+01	2.00E-06
1.10E+04	3.05E+00	4.57E+00	-999
-999	4.57E+00	1.37E+01	1.00E-02
6.94E+03	2.13E+00	7.99E+00	4.00E-03
6.31E+03	7.01E+00	5.18E+00	4.90E-02
2.37E+04	4.88E+00	1.83E+01	3.30E-02
1.77E+04	5.79E+00	4.27E+01	2.00E-03
1.89E+03	4.57E+00	1.07E+01	4.00E-06
1.45E+04	1.52E+00	1.83E+01	1.20E-02
1.20E+05	2.20E+01	-999	1.00E-02
2.52E+03	1.52E+00	6.10E+00	1.10E-02
1.26E+01	5.79E+00	4.27E+00	2.10E-02
3.15E+02	6.10E-01	4.57E+00	6.00E-03
3.15E+01	4.57E-01	-999	1.00E-03
-999	4.57E+01	3.05E+00	-999

Note: -999 indicates a missing sample value.

Table D.18 Hydrogeologic Statistics for HG Environment 7

Subsurface Environment Statistics			
River Valleys and Flood Plains without overbank deposits			
Mean Values			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
-5.22204	2.81441	3.78819	-5.30668
Covariance Matrix			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
Hydraulic Conductivity In(cm/s)			
13.0649			
Unsaturated Zone Thickness In(ft)	-1.10808	1.13841	
Saturated Zone Thickness In(ft)	0.50353	0.0496	1.11517
Regional Hydraulic Gradient In(ft/ft)	-0.73884	0.26902	-0.46202
			1.11713

Table D.19 Hydrogeologic Database for HG Environment 8

Subsurface Environment Description			
Outwash			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
6.31E+03	7.62E+00	6.10E+01	1.00E-03
2.40E+04	4.88E+00	2.29E+01	2.00E-03
3.00E+04	2.99E+00	1.89E+01	4.00E-03
-999	1.22E+01	6.71E+00	1.00E-03
2.52E+03	3.05E+00	2.13E+01	8.00E-07
1.10E+05	9.14E+00	2.13E+01	4.00E-03
1.33E+04	5.49E+00	1.22E+01	6.00E-03
3.78E+04	4.57E+00	9.14E+00	3.00E-03
1.26E+03	1.07E+01	-999	8.00E-03
2.21E+03	3.05E+00	2.29E+01	9.00E-04
9.78E+03	3.35E+00	1.52E+01	7.00E-04
1.89E+03	4.88E+01	3.20E+01	3.00E-02
3.44E+04	7.62E+00	2.62E+01	6.00E-03
4.42E+04	4.88E+00	1.86E+01	2.00E-03
1.58E+04	2.90E+01	2.44E+01	1.00E-03
7.25E+03	9.14E+00	3.96E+01	6.00E-04

Table D.19 Hydrogeologic Database for HG Environment 8

Subsurface Environment Description			
Outwash			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
1.39E+04	1.22E+01	1.22E+02	2.00E-03
2.90E+04	2.74E+00	1.01E+01	-999
9.97E+04	2.13E+00	7.01E+00	7.00E-04
-999	4.57E+00	6.10E+00	3.00E-03
1.48E+04	1.83E+00	6.10E+01	1.00E-03
7.88E+03	2.44E+00	3.05E+00	3.00E-02
-999	1.52E+01	7.62E+01	9.00E-04
5.68E+03	2.44E+00	6.10E+00	1.00E-03
1.89E+04	4.57E+00	7.62E+00	5.00E-03
3.88E+03	3.66E+00	7.62E+00	4.00E-03
-999	2.20E+01	1.83E+01	6.00E-04
4.73E+02	6.10E+00	4.57E+00	1.70E-02
1.04E+04	7.62E+00	3.05E+01	1.00E-03
2.21E+04	9.14E+00	7.62E+00	5.00E-03
2.78E+04	7.62E+00	2.44E+01	2.00E-03
2.78E+04	7.62E+00	2.44E+01	2.00E-03
-999	6.10E+00	4.57E+00	4.00E-05
1.10E+04	1.22E+01	3.05E+00	7.50E-02
1.92E+04	5.33E+00	1.22E+01	8.00E-03
6.31E+02	9.14E-01	1.07E+01	1.00E-02
1.92E+04	1.83E+01	1.07E+01	1.30E-02
5.05E+03	6.10E-01	1.22E+01	3.00E-03
-999	7.62E+00	3.05E+01	2.00E-03
3.31E+04	1.52E+01	3.05E+01	4.00E-04
-999	4.57E+00	2.29E+01	1.00E-02
2.21E+03	2.13E+00	3.66E+00	2.00E-02
6.09E+04	2.00E+01	3.05E+01	3.00E-03

Note: -999 indicates a missing sample value.

Table D.20 Hydrogeologic Statistics for HG Environment 8

Subsurface Environment Statistics			
Outwash			
Mean Values			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
-3.59646	2.97372	3.92385	-5.86511
Covariance Matrix			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
Hydraulic Conductivity In(cm/s)			
5.02			
Unsaturated Zone Thickness In(ft)	0.4862	0.85551	
Saturated Zone Thickness In(ft)	0.1547	0.26963	0.75329
Regional Hydraulic Gradient In(ft/ft)	-0.8019	0.07004	-0.62236
			1.62199

Table D.21 Hydrogeological Database for HG Environment 9

Subsurface Environment Description			
Till and Till over outwash			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
9.46E+02	2.10E+00	1.37E+01	5.00E-02
3.15E+02	1.37E+01	1.22E+01	1.00E-03
1.89E+01	3.66E+00	5.49E+00	8.00E-03
2.18E+04	6.10E+00	1.52E+01	4.00E-03
3.47E+03	3.96E+01	5.49E+01	1.70E-02
3.15E+03	2.13E+01	4.57E+00	1.00E-02
1.26E+02	1.00E+00	3.00E+01	-999
3.15E+01	7.62E+00	3.05E+00	9.00E-03
-999	3.05E+00	3.05E+01	5.00E-07
3.15E+01	5.18E+00	1.07E+01	3.00E-02
3.15E+02	3.96E+00	2.29E+01	7.00E-03
6.31E+01	4.57E+00	2.96E+00	2.20E-02
9.15E+02	2.44E+00	1.22E+01	7.00E-04
-999	7.32E+00	1.22E+01	-999
1.89E+03	1.83E+00	9.14E-01	5.00E-03
3.15E+03	7.62E+00	7.62E+00	-999
6.31E+02	3.66E+00	2.13E+00	-999

Table D.21 Hydrogeological Database for HG Environment 9

Subsurface Environment Description			
Till and Till over outwash			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
6.31E+03	2.44E+00	9.14E+00	4.00E-08
-999	2.13E+00	7.62E+00	9.00E-03
4.10E+03	1.52E+00	6.10E+00	1.00E-02
1.26E+02	3.05E+00	4.57E+00	5.00E-02
1.26E+02	3.05E+00	7.62E+00	2.00E-02
-999	6.10E-01	1.83E+00	-999
1.26E+01	1.83E+00	-999	4.00E-02
8.83E+03	1.52E+00	1.83E+01	4.00E-03
3.15E+02	1.52E+00	6.10E+00	-999
2.84E+02	1.74E+00	9.14E+00	1.00E-02
9.46E+00	1.83E+01	2.44E+00	3.00E-03
1.58E+03	3.35E+00	6.10E+00	4.00E-06

Note: -999 indicates a missing sample value.

Table D.22 Hydrogeologic Statistics for HG Environment 9

Subsurface Environment Statistics			
Till and Till over outwash			
Mean Values			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
-7.67984	2.48552	3.22796	-4.68545
Covariance Matrix			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
Hydraulic Conductivity In(cm/s)			
11.259			
Unsaturated Zone Thickness In(ft)	0.17085	0.87319	
Saturated Zone Thickness In(ft)	0.72472	0.13478	0.81983
Regional Hydraulic Gradient In(ft/ft)	-0.72109	-0.12094	-0.0043
			1.28625

Table D.23 Hydrogeologic Database for HG Environment 10

Subsurface Environment Description			
Unconsolidated and Semiconsolidated Shallow Aquifers			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
-999	3.35E+00	1.46E+01	3.00E-02
4.42E+03	1.16E+01	5.49E+01	5.00E-03
2.84E+02	4.57E+00	7.62E+00	1.00E-02
1.96E+04	3.96E+01	2.14E+01	3.00E-04
1.58E+02	4.57E+00	3.05E+00	6.00E-04
3.15E+02	1.52E+00	6.10E+00	4.00E-03
-999	6.10E+00	3.66E+00	1.00E-06
1.26E+02	7.62E+00	2.29E+00	5.00E-03
3.15E+02	1.52E+01	1.07E+01	1.00E-02
3.15E+01	2.74E+00	6.86E+00	1.70E-02
1.26E+02	3.05E+00	4.12E+00	3.00E-03
-999	3.81E+00	6.10E+00	1.00E-05
-999	3.66E+00	1.52E+01	1.00E-01
6.31E+02	4.57E+00	9.14E-01	5.00E-03
3.47E+03	3.05E+00	3.05E+00	2.00E-03
2.21E+03	2.59E+01	7.62E+00	1.00E-05
-999	1.52E+00	1.52E+01	2.00E-03
2.84E+03	2.74E+00	4.57E+00	-999
-999	1.83E+00	2.44E+00	8.00E-03
2.21E+03	1.37E+01	7.62E+00	1.00E-02
1.26E+02	1.22E+01	1.22E+01	2.50E-02
-999	3.81E+00	1.68E+01	2.00E-03
-999	3.32E+00	1.83E+00	6.00E-02
3.15E+00	3.66E+00	1.16E+01	1.00E-02
2.52E+01	1.83E+00	4.57E+00	9.50E-03
4.42E+03	1.07E+01	9.14E+00	1.40E-02
-999	6.10E+00	4.27E+01	1.75E-03

Note: -999 indicates a missing sample value.

Table D.24 Hydrogeologic Statistics for HG Environment 10

Subsurface Environment Statistics			
Unconsolidated and Semiconsolidated Shallow Aquifers			
Mean Values			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
-6.97635	2.80942	3.15655	-5.57335
Covariance Matrix			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
4.99889			
1.27993	0.86035		
0.51266	0.40799	0.8467	
-1.74813	-0.71454	0.03369	3.61694

Table D.25 Hydrogeologic Database for HG Environment 11

Subsurface Environment Description			
Coastal Beaches			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
9.46E+02	2.13E+00	3.05E+02	1.00E-02
6.31E+01	2.74E+00	3.05E+01	3.00E-02
7.25E+03	9.14E+00	3.66E+01	6.00E-04
2.43E+04	4.57E+00	1.07E+01	6.80E-03
-999	1.52E+00	3.05E+02	1.00E-03
7.57E+03	3.05E+00	4.57E+01	6.00E-03
1.26E+04	9.14E-01	4.57E+00	5.00E-03
6.31E+02	9.14E-01	6.10E+00	1.00E-02
3.15E+03	1.52E+00	6.10E+00	-999
1.26E+03	1.22E+00	1.07E+01	2.00E-03
3.15E+01	9.14E-01	1.52E+01	5.00E-03
1.39E+04	1.52E+00	6.10E+01	2.00E-03
-999	1.68E+00	1.52E+01	2.00E-03
2.52E+03	2.00E+00	2.00E+00	2.00E-03
1.26E+03	1.22E+00	3.05E+00	1.70E-02
-999	9.14E-01	7.62E+00	-999

Table D.25 Hydrogeologic Database for HG Environment 11

Subsurface Environment Description			
Coastal Beaches			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
3.15E+02	1.52E+00	1.52E+00	5.00E-02
1.58E+03	2.74E+00	4.57E+00	2.30E-02
-999	3.35E+00	4.27E+00	1.90E-02
3.15E+02	3.05E+00	2.44E+01	1.00E-03
2.84E+02	1.07E+00	3.05E+01	3.00E-03
9.46E+02	2.13E+00	1.68E+00	2.00E-04
-999	2.74E+00	2.13E+01	3.00E-05
8.17E+03	7.01E+00	6.10E+00	3.30E-03
-999	-999	6.71E+00	-999
-999	3.05E+00	4.27E+01	5.00E-04

Note: -999 indicates a missing sample value.

Table D.26 Hydrogeologic Statistics for HG Environment 11

Subsurface Environment Statistics			
Coastal Beaches			
Mean Values			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
-5.38023	1.8991	3.7492	-5.61773
Covariance Matrix			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
Hydraulic Conductivity In(cm/s)			
3.48349			
Unsaturated Zone Thickness In(ft)	0.52513	0.46903	
Saturated Zone Thickness In(ft)	-0.00429	0.18069	2.02612
Regional Hydraulic Gradient In(ft/ft)	-0.63963	-0.2284	-0.08327
			1.97797

Table D.27 Hydrogeologic Database for HG Environment 12

Subsurface Environment Description			
Solution Limestone			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
1.58E+05	3.00E+01	3.00E+01	6.00E-03
-999	5.00E+01	1.00E+01	5.00E-03
1.58E+03	5.08E+01	1.44E+02	2.30E-02
-999	1.52E+01	9.14E+01	-999
-999	3.05E+00	-999	1.20E-02
1.58E+03	4.57E+01	-999	-999
1.26E+02	3.05E+00	1.52E+01	5.00E-05
3.15E+02	1.22E+01	6.10E+01	3.30E-02
-999	3.05E+01	-999	2.00E-02
-999	3.20E+02	-999	9.00E-03
-999	5.33E+00	1.52E+01	1.00E-03
1.58E+04	2.93E+01	1.95E+01	-999
-999	1.83E+01	-999	-999
2.21E+02	-999	3.96E+01	2.00E-03
3.15E+02	3.96E+00	3.05E+00	1.80E-02
2.49E+04	1.52E+00	-999	2.00E-03
1.23E+04	3.96E+00	1.83E+01	9.00E-03
-999	3.05E+00	3.05E+02	1.00E-03
9.46E+01	7.62E+00	1.98E+01	1.00E-02
1.26E+03	4.00E+02	1.80E+01	2.00E-06
2.18E+03	1.68E+00	7.32E+00	4.20E-04
6.31E+03	1.22E+00	3.05E+00	-999

Note: -999 indicates a missing sample value.

Table D.28 Hydrogeologic Statistics for HG Environment 12

Subsurface Environment Statistics			
Solution Limestone			
Mean Values			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
-5.6496	3.47765	4.32063	-5.49537
Covariance Matrix			
Hydraulic Conductivity In(cm/s)	Unsaturated Zone Thickness In(ft)	Saturated Zone Thickness In(ft)	Regional Hydraulic Gradient (m/m)
Hydraulic Conductivity In(cm/s)			
12.0503			
Unsaturated Zone Thickness In(ft)	1.43257	1.25667	
Saturated Zone Thickness In(ft)	0.53279	0.99541	1.2437
Regional Hydraulic Gradient In(ft/ft)	0.79733	1.35511	0.81132
			4.45451

Table D.29 Hydrogeologic Database for HG Environment 13

Subsurface Environment Description			
Undefined Hydrogeological Region			
(Parameters values represent the average of the 12 regions).			
Hydraulic Conductivity (m/yr)	Unsaturated Zone Thickness (m)	Saturated Zone Thickness (m)	Regional Hydraulic Gradient (m/m)
1890	5.18	10.1	5.70E-03